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I

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general notes

- Data in this report were collected by the Bureau of the Census for the National Science Foundation (NSF) in the annual Survey of Industrial Research and Development and cover the periods 1956-81 for funding data and January 1957-January 1982 for personnel data.
- The footnote, "Not separately available but included in total," indicates that data are being withheld either (1) to avoid disclosing the operations of an individual company; or, (2) the imputation rate—the percentage of that statistic estimated by the Census Bureau—exceeds 50 percent because of the failure of some companies to supply the requested data. See table A-1 for the imputation rates of specific items.
- The industry survey does not cover trade associations. Although their primary mission is to serve industry, trade associations are established as nonprofit organizations and are covered in the NSF survey of independent nonprofit institutions. R&D expenditures of trade associations are estimated at less than 1 percent of the industry R&D total.
- Complete technical notes are contained in section A. Questions regarding these survey findings should be addressed to Melissa Pollak or Mary Burke, Industry Studies Group, Division of Science Resources Studies, National Science Foundation, Washington, D.C. 20550 (202) 634-4648.

section a

technical notes

scope of study

The National Science Foundation (NSF) sponsored its first survey of industrial research and development in 1953. Since then, the scope of the survey has gradually been expanded and refined in response to an increasing need for more detailed information on the Nation's research and development (R&D) effort.

The 1981 industry survey is the 25th in the annual series sponsored by NSF and conducted by the Bureau of the Census, Department of Commerce. NSF also sponsored two industry surveys covering the 1953-56 period, which were conducted by the Bureau of Labor Statistics (BLS), U.S. Department of Labor.[1] Data obtained in the BLS survey are not directly comparable with the Census figures for 1957-81 because of methodological and other differences in the surveys conducted by the two agencies. In addition, beginning in 1975, the Census surveys have collected data on the R&D activities of federally funded research and development centers (FFRDC's) operated by business firms, whereas the earlier BLS surveys did not. FFRDC's are organizations administered by industrial, educational, or other institutions on a nonprofit basis; they conduct R&D activities almost exclusively for the use of the Federal Government. R&D expenditures of industry-administered FFRDC's are included in the Federal R&D data under the classifications of the administering firms. Total R&D expenditures and selected personnel data for FFRDC's are shown in table B-15. To account for the performance of these research centers in 1956, Census adjusted data for that year (collected in the 1957 survey) to provide comparable trend data for 1956 and earlier years.

Data on scientific personnel are not directly comparable with data in the surveys formerly conducted by BLS. Census uses the company, defined to include all establishments under common ownership or control, as the basic reporting unit for the survey of industrial research and development. The surveys of scientific and technical personnel conducted by BLS were on an establishment-reporting-unit basis. Further, Census obtains data on the number of R&D scientists and engineers on a full-time-equivalent (FTE) basis, unlike the BLS surveys in which data were provided in terms of scientists and engineers primarily employed in research and development.

Other variations in the two sets of data may be the result of different offices in the same company preparing the estimates or the varying response rates of the two surveys. The statistics presented in this report are subject to response and concept errors caused by differences between survey and industry concepts and definitions of R&D activities, and by variations in company accounting procedures. Consequently, the accuracy of the data provided by respondents is subject to some variation.

Data quality has improved substantially since the first industry survey in 1953, mainly as a result of more accurate and sophisticated accounting procedures adopted by respondents. In addition, NSF and Census have endeavored to reduce response and concept errors arising from difficulties in interpreting or applying survey definitions.

NSF has been aware of the increased reporting burden placed on industry from all sources in recent years. In an effort to alleviate this burden, the detailed questionnaire (which has been in use with slight modifications since the beginning of the survey) is now mailed only biennially; an abbreviated form containing only the most crucial data elements is sent to survey respondents in the intervening years.

The shortened survey form was used for the first time to collect industrial R&D data for 1978. Because all data elements were not collected for 1978 and 1980, some of the historical tables do not contain data for these years. In addition, other tables which were not printed in the 1978 and 1980 publications because the data were not collected in those years appear in this report with data collected in the 1981 survey. The main tables affected are those which give detailed breakdowns of R&D expenditures for basic research, applied research, and development by industry and by product field. Other tables deleted in the 1978 and 1980 publications include company-financed research and development contracted to outside organizations, Federal funds by agency, and R&D expenditures by geographic area. This report contains all of these tables.

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[1] National Science Foundation, *Science and Engineering in American Industry, Final Report on a 1953-54 Survey* (NSF 56-16) and *Science and Engineering in American Industry, 1956* (NSF 59-50) (Washington, D.C.: Supt. of Documents, U.S. Government Printing Office, 1956 and 1960.)

The industrial R&D data are presented on two different bases. First, R&D data are furnished on an industry-by-industry basis (tables B-1 to B-33 and B-38 to B-60). The second approach presents applied research and development data on a product field basis (tables B-34 to B-37). Classification by industry and product field is based on the Standard Industrial Classification (SIC) code. Because of its generalized nature, basic research cannot readily be classified by product field; instead, the data are classified by field of science and engineering.

survey definitions[2]

Research and development—Basic and applied research in the sciences and engineering and the design and development of prototypes and processes. This definition excludes quality control, routine product testing, market research, sales promotion, sales service, research in the social sciences or psychology, and other nontechnological activities or technical services.

Basic research—Original investigations for the advancement of scientific knowledge not having specific commercial objectives, although such investigations may be in fields of present or potential interest to the reporting company.

Applied research—Investigations directed to the discovery of new scientific knowledge having specific commercial objectives with respect to products or processes. This definition differs from that of basic research chiefly in terms of the objectives of the reporting company.

Development—Technical activities of a nonroutine nature concerned with translating research findings or other scientific knowledge into products or processes. Not included are routine technical services to customers or other activities excluded from the above definition of research and development.

Funds for research and development—Operating expenses incurred by a company in the conduct of research and development in its own laboratories or other company-owned or -operated facilities. Includes wages and salaries, materials and supplies consumed, property and other taxes, maintenance and repairs, depreciation, and an appropriate share of overhead, but excludes capital expenditures. All funds for R&D performance are expressed in current rather than constant dollars.

Federally financed research and development—Receipts for work done by the company on Federal R&D contracts or subcontracts and R&D portions of procurement contracts and subcontracts.

Company-financed research and development—Cost of the company-sponsored research and development performed within the company. Does not include company-financed research and development contracted to outside organizations, such as research institutions, universities and colleges, or other nonprofit organizations.

R&D scientists and engineers—The January number of those engaged full time in research and development and the full-time equivalent (FTE) of those working part time in research and development. Scientists and engineers are defined as persons engaged in scientific or engineering work at a level which requires a knowledge of physical, life, engineering, or mathematical sciences equivalent at least to that acquired through completion of a 4-year college program with a major in one of those fields.

Employment—Total number of persons domestically employed by the company in all activities during the pay period which includes the 12th of March. These data are not completely comparable with employment of R&D scientists and engineers data which are collected as of January.

Net sales and receipts—Recorded dollar values for goods sold or services rendered by a company to customers outside the company, including the Federal Government, less such items as returns, allowances, freight charges, and excise taxes. Excludes domestic intracompany transfers as well as sales by foreign subsidiaries, but includes transfers to foreign subsidiaries and export sales to foreign companies. For companies classified in communication equipment industry (SIC 366), manufacturing sales are included and revenues from their telecommunication activities are excluded. Net sales and receipts figures are expressed in current rather than constant dollars. All tables which include net sales figures, with the exception of table B-20, do not include data for nonmanufacturing companies.

Geographic area covered—Includes only those operations located in the 50 States and the District of Columbia.[3]

explanation of tabular data

Industry classification—Industries and industry groups shown separately in statistical tables are classified according to their Standard Industrial Classification Manual[4] codes as follows:

- Food and kindred products (20)
- Textiles and apparel (22, 23)
- Lumber, wood products, and furniture (24, 25)
- Paper and allied products (26)
- Chemicals and allied products (28)
  - Industrial chemicals (281-82, 286)[5]
  - Drugs and medicines (283)
  - Other chemicals (284-85, 287-89)[5]
- Petroleum refining and related industries (29)[6]
- Rubber products (30)
- Stone, clay, and glass products (32)

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[2] For more detailed information on definitions, as well as the instructions for individual items covered in the survey questionnaire, see section C

[3] For purposes of comparison, company-sponsored research and development by foreign affiliates of U.S. domestic companies performed outside the United States is reported in table B-9 but excluded from all other tables.

[4] Executive Office of the President, Office of Management and Budget, *Standard Industrial Classification Manual, 1972* (Washington, D.C.: Supt. of Documents, U.S. Government Printing Office.) Industry group code numbers are shown in parentheses.

[5] The classification "Industrial Chemicals" has been revised to include SIC Group 286, Industrial Organic Chemicals. All current and historical tables have been revised accordingly.

[6] Starting with the 1978 survey, oil and gas extraction (13) was no longer grouped with petroleum refining (29), and communication (48) was no longer grouped with electrical equipment (36). Instead, these SIC groups are included in the nonmanufacturing sector so that the delineation between manufacturing and nonmanufacturing industries is more consistent. This change has had almost no effect on the levels of the data.

- Primary metals (33)
  - Ferrous metals and products (331-32, 3398-99)
  - Nonferrous metals and products (333-36)
- Fabricated metal products (34)
- Machinery (35)
  - Office, computing, and accounting machines (357)
  - Other machinery, except electrical (351-56, 358-59)
- Electrical equipment (36)[6]
  - Radio and TV receiving equipment (365)
  - Communication equipment (366)[6]
  - Electronic components (367)
  - Other electrical equipment (361-64, 369)
- Motor vehicles and motor vehicles equipment (371)
- Other transportation equipment (373-75, 379)
- Aircraft and missiles (372, 376)[7]
- Professional and scientific instruments (38)
  - Scientific and mechanical measuring instruments (381-82)
  - Optical, surgical, photographic, and other instruments (383-87)
- Other manufacturing industries—tobacco manufactures (21), printing and publishing (27), leather products (31), and miscellaneous manufacturing industries (39)
- Nonmanufacturing industries—agriculture, forestry, and fisheries (07-09); mining and extraction (10-14); contract construction (15-17); transportation, communication, and other public utilities (41-49); wholesale and retail trade (50-59); finance, insurance, and real estate (60-67); and selected service industries (739, 807, 891).

Company size-class—The size of a company as determined by the total number of its employees. The five company size-classes used in this report are: less than 1,000 employees; 1,000 to 4,999 employees; 5,000 to 9,999 employees; 10,000 to 24,999 employees; and 25,000 or more employees.

Classification of reporting units—The company or corporate family which includes all establishments under common ownership or control is the basic reporting unit. Each company was similarly classified into a single size-category on the basis of its total employment.

Cost per R&D scientist or engineer—The number of R&D scientists and engineers used to estimate the cost per R&D scientist or engineer for 1957-81 is the arithmetic mean of the numbers of R&D scientists and engineers reported in each industry for January in two consecutive years. This number is then divided into total R&D expenditures in each industry. For example, the mean of the numbers of R&D scientists and engineers in January 1981 and January 1982 is divided into total 1981 R&D expenditures for a total cost per scientist or engineer in 1981.

Nonavailability of certain statistics—Tables in section B use footnotes stating "not separately available but included in total," indicating that statistics are withheld for not meeting publication standards for the following reasons: extremely high associated sampling error of estimate; high rate of imputation (over 50 percent) because of failure of companies to supply data; possible disclosure of data on an individual company; or data inconsistent for inclusion in a time series. In some instances, withheld data can be derived by subtraction from higher level totals. Where this is possible, the data user should be aware that the derived numbers are statistically unreliable. In *no* instance, however, can any data be derived which would disclose the operations of an individual company.

Questionable data—Data where over 50 percent of the total has been estimated are not published. Users should consult table A-1 for imputation rates for specific items.

Method of computation—Detailed statistics in the tables may not add to totals or subtotals because of rounding. Also, percentages were calculated on the basis of thousands of dollars and may differ from those based on the rounded figures shown.

methodology of survey[8]

The sample used for the 1981 Survey of Industrial Research and Development represents all manufacturing industries and those nonmanufacturing industries known, on the basis of earlier, more detailed samples, to conduct or to finance research and development. The sampling unit for the survey was the company, defined as a business organization consisting of one or more establishments under common ownership or control. A new panel for the R&D survey is selected approximately every five years. The newest sample was selected for the 1981 survey (the first since the 1976 survey). Approximately 11,500 manufacturing and nonmanufacturing companies are included in this sample, which consists of about 4,500 certainty companies (those with 100-percent chance of inclusion in the panel) and about 7,000 noncertainty companies.

The basic tool for the survey is Form RD-1, which is used to collect detailed R&D information. Companies in the new panel that received an RD-1 form in the old panel once again received an RD-1 form in 1981 (about 1,200 companies). The remaining certainty (about 3,300) companies and noncertainty companies (about 7,000) in the new panel received an RD-1A survey form in 1981. Form RD-1A is an abbreviated version of RD-1 and is only mailed to companies in the year in which a new sample is drawn. The purpose of form RD-1A is to canvass, with a minimum of reporting burden, smaller R&D performers. Once the RD-1A forms were received and tabulated from the survey respondents in 1981, they were reviewed for total R&D expenditures. Those companies reporting R&D expenditures exceeding $1,000,000 on the RD-1A form were added to the survey panel and will subsequently receive the RD-1 form annually. There were about 575 such companies in 1981. The remaining RD-1A companies are not surveyed annually but data for them are estimated in subsequent years by the Bureau of the Census based upon their 1981 reports.

The universe frame from which the latest sample panel was selected was created from two sources: the 1981 Standard Statistical Establishment List (SSEL) for single units and the 1981 Enterprise Statistics Multiunits file. There are about 3.5 to 4 million single-unit firms in the 1981 SSEL file (including nonmanufacturing firms). There are 5.6 million multiunit companies in the 1981 Enterprise file, of which 296,146 companies have identified themselves as being primarily in manufacturing. All manufacturing industries and selected nonmanufacturing industries (SIC's 49, 7391, 7392, 7399, and 8911) were considered within the scope of the survey. Companies in these industries with 500 or more employees were included in the panel with certainty. For the companies with fewer than 500 employees, a measure of size was assigned to each company based

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[7] Companies primarily engaged in the manufacture of ordnance and accessories, including complete guided missiles, are grouped with companies primarily engaged in the manufacture of aircraft and parts because of close similarity of R&D activities carried out by major companies in the two industries.

[8] This section was prepared in the Industry Division of the Bureau of the Census, the collecting and compiling agent for NSF in this survey.

Table A-1. Imputation rates for selected items on the research and development survey by industry: 1981

[Percent]

Industry	SIC code	Item 2		Item 4	Item 5 - R&D expenditures											
					Basic research			Applied research			Development			Total R&D		
		Sales[1]	Employment[1]	Scientists/ engineers[1]	Total	Federal	Company	Total	Federal	Company	Total	Federal	Company	Total[1]	Company[1]	Federal[1]
Total		6.3	4.6	26.5	22.8	32.6	20.5	32.4	20.0	35.5	34.4	20.1	40.4	1.7	2.2	1.0
Distribution by industry																
Food and kindred products	20	9.5	14.1	36.1	5.3	-	5.3	39.0	-	39.0	32.9	-	33.2	7.5	7.6	-
Textiles and apparel	22,23	6.3	6.0	22.3	4.4	-	4.4	38.6	-	39.7	40.3	-	40.3	7.3	7.3	-
Lumber, wood products, and furniture	24,25	11.5	27.9	55.4	23.1	1.3	23.1	13.3	-	13.3	22.2	-	22.2	7.3	7.3	-
Paper and allied products	26	6.1	5.1	20.1	9.6	-	9.6	30.8	-	31.0	17.4	-	17.4	2.5	2.5	-
Chemicals and allied products	28	2.5	3.0	28.5	24.3	1.3	28.5	39.2	4.0	41.3	37.3	9.6	39.3	2.2	2.3	1.6
Industrial chemicals	281-82,236	3.0	3.7	17.4	4.9	.9	6.2	33.8	3.0	37.7	35.4	9.2	40.0	1.6	1.7	1.6
Drugs and medicines	283	2.4	2.2	44.4	61.5	100.0	61.5	53.3	54.1	52.9	49.2	23.3	49.3	2.6	2.6	.2
Other chemicals	284-85,287-89	1.6	2.7	16.1	15.1	-	15.1	15.1	3.9	15.4	14.3	-	14.3	3.0	3.0	3.9
Petroleum refining and related industries	29	3.0	1.7	36.7	3.4	-	3.4	10.4	79.3	6.8	8.5	17.5	7.5	1.3	1.3	1.4
Rubber products	30	-	-	54.6	49.8	-	49.8	71.7	43.0	73.9	58.6	39.1	67.8	1.2	1.6	-
Stone, clay, and glass products	32	.1	-	33.7	1.3	-	3.5	26.9	-	26.9	26.5	1.9	31.1	-	-	-
Primary metals	33	12.8	1.0	18.0	5.1	-	5.2	35.2	-	35.9	20.0	.8	30.6	.6	.8	-
Ferrous metals and products	331-32,3398-99	-	-	20.8	.1	-	.1	55.8	-	56.2	18.9	1.0	32.4	-	-	-
Nonferrous metals and products	333-36	34.2	4.0	13.3	15.0	-	15.0	10.9	-	11.4	22.4	-	27.8	1.8	2.0	-
Fabricated metal products	34	13.5	12.9	37.9	2.1	-	2.2	42.6	2.1	46.7	43.9	43.6	44.0	15.8	16.4	11.3
Machinery	35	3.0	12.0	20.8	24.3	25.6	24.6	31.6	5.9	37.9	19.0	14.1	19.4	1.4	1.8	.6
Office, computing, and accounting machines	357	.8	.8	19.1	24.4	-	25.1	21.2	.3	28.3	13.4	1.2	15.0	.3	.4	.3
Other machinery, except electrical	351-56,358-59	3.9	17.2	24.2	24.1	63.1	24.1	55.6	64.3	55.1	32.0	50.5	29.2	30.5	28.7	61.5
Electrical equipment	36	4.0	4.4	26.1	15.6	41.2	10.2	22.7	14.6	25.6	24.6	23.7	24.9	2.2	2.6	2.3
Radio and TV receiving equipment	365	2.3	2.7	11.4	-	-	-	48.7	-	62.0	-	-	1.4	.3	.6	-
Communication equipment	366	4.3	4.4	17.2	9.7	34.5	4.0	18.2	17.5	18.4	14.9	20.8	9.6	2.8	2.1	4.6
Electronic components	367	3.1	2.5	39.0	88.5	100.0	87.4	41.9	79.0	38.0	53.1	50.8	54.2	2.7	3.2	1.2
Other electrical equipment	361-64,369	4.5	5.4	33.4	34.3	82.2	26.6	16.6	10.2	21.2	30.8	23.6	37.2	1.6	2.7	.3
Motor vehicles and motor vehicles equipment	371	1.9	2.5	15.9	30.2	100.0	29.6	88.2	88.4	88.2	90.2	79.0	92.1	.4	.4	-
Other transportation equipment	373-75,379	30.5	22.0	16.8	52.9	63.4	-	35.7	37.2	35.6	24.8	10.9	34.9	6.4	9.7	2.4
Aircraft and missiles	372,376	.9	1.2	17.3	14.5	12.6	15.8	6.2	6.4	6.0	5.9	5.5	6.8	.2	.9	-
Professional and scientific instruments	38	.3	.2	48.7	77.5	65.1	79.5	59.9	94.1	55.3	76.2	68.8	78.0	.8	.8	.4
Scientific and mechanical measuring instruments	381-82	.7	.2	53.6	80.0	100.0	73.0	47.2	96.1	36.3	65.8	93.0	54.8	1.6	2.1	.3
Optical, surgical, photographic, and other instruments	383-87	.1	-	42.5	76.1	-	82.4	73.0	70.6	73.1	83.7	32.1	91.7	-	-	.6
Other manufacturing industries	21,27,31,39	.8	.8	48.1	10.5	-	10.5	65.1	100.0	65.0	58.2	37.2	58.3	3.0	3.0	-
Nonmanufacturing industries	07-17,41-67, 737,739,807,891	6.3	7.3	34.7	67.1	42.2	89.5	44.4	27.6	45.0	53.7	55.6	52.1	7.7	8.8	6.0

- Represents no imputation.

[1] These items calculated from Form RD-1 (detailed form mailed to large corporations conducting research and development) and from Form RD-1A (abbreviated version of RD-1 form mailed to smaller R&D performers). All other items calculated from Form RD-1 only; RD-1A respondents were not asked these questions.

on an estimate of its total R&D expenditures. Probabilities of selection were then assigned based on the measure of size. Finally, a sample selection process gave each company an independent chance of being included in the sample.

Each year the Census Bureau reviews the annual lists of R&D contractors published by the Department of Defense (DOD) and the National Aeronautics and Space Administration (NASA) to ensure that the large contractors are included in the sample. For the 1981 survey, the R&D-performing manufacturing companies from the largest DOD and NASA contractors were included in the reporting panel with certainty.

The particular sample selected is one of a large number of samples of the same type and size that, by chance, might have been selected. Estimates from each of the different samples would differ somewhat from each other, and from the results of a complete canvass conducted under essentially the same conditions as the survey. This variation among the possible estimates is defined by the sampling error, measured in standard error units. The complete canvass total would be included in the range—

1. From one standard error below to one standard error above the derived estimate for about two-thirds of all possible samples.
2. From two standard errors below to two standard errors above the derived estimate for about 95 percent of all possible samples.
3. From three standard errors below to three standard errors above the derived estimate, almost always.

An inference that the comparable complete canvass total would be within the indicated ranges would be correct in approximately the relative frequencies shown. Those proportions, therefore, may be interpreted as defining the confidence that the estimates from a particular sample would differ from complete coverage results by as much as one, two, or three standard errors, respectively.

For example, suppose an estimated total is shown as 400 with an associated relative standard error of 2 percent. Then, there is approximately 67-percent confidence that the interval 392 to 408 includes the complete canvass total, about 95-percent confidence that the interval 384 to 416 includes the complete canvass total, and almost certain confidence that the interval 376 to 424 includes the complete canvass total.

In addition to the sampling errors as measured by the standard error, the estimates are subject to errors in response, coding, processing, and imputation for

Table A-1. Imputation rates for selected items on the research and development survey by industry: 1981--Continued

[Percent]

Item 7			Item 8			Item 9				Item 11		Item 12	Item 13	SIC code	Industry
R&D by cost			Fields of basic research			Applied R&D by product field									
Wages	Mate-rials	Other costs	Total	Chem-istry	Engi-neering	Total	Electrical equipment	Aircraft and parts	Motor vehicles	Energy R&D	Pollution abatement	Outside company[1]	Foreign R&D		
36.9	35.8	26.0	32.4	40.4	24.0	27.5	27.4	11.8	43.3	27.4	53.0	-	11.3		Total
															Distribution by industry
43.9	45.1	40.0	5.3	9.1	11.8	43.1	6.6	-	-	17.8	16.1	-	29.9	20	Food and kindred products
42.0	41.5	27.0	28.1	7.6	-	43.1	-	-	-	-	11.3	-	28.2	22,23	Textiles and apparel
51.3	43.6	51.5	100.0	100.0	-	47.0	-	-	-	8.1	-	-	-	24,25	Lumber, wood products, and furniture
14.9	16.6	15.3	4.9	-	-	19.4	-	-	-	-	12.6	-	6.2	26	Paper and allied products
48.7	54.2	37.0	37.7	40.1	1.5	29.6	11.2	-	-	4.2	6.4	-	21.6	28	Chemicals and allied products
50.2	55.7	34.0	23.3	11.7	1.3	12.3	.5	-	-	4.0	5.6	-	4.6	281-82,286	Industrial chemicals
52.0	59.4	41.8	68.9	87.6	3.2	50.6	2.2	-	-	-	6.5	-	34.3	283	Drugs and medicines
35.2	28.2	34.0	13.9	17.8	-	30.1	94.8	-	-	15.2	14.4	-	2.7	284-85,287-89	Other chemicals
34.9	55.5	27.7	59.9	53.4	60.9	39.8	84.8	-	100.0	32.0	17.4	-	43.7	29	Petroleum refining and related industries
78.6	67.3	86.4	49.2	94.2	98.9	62.3	11.7	81.0	100.0	12.7	54.8	-	73.7	30	Rubber products
27.0	19.0	17.1	4.0	-	-	35.0	25.1	-	24.2	18.0	5.3	1.2	40.8	32	Stone, clay, and glass products
16.0	20.4	13.5	17.2	29.3	17.5	18.1	-	-	21.0	4.4	-	-	1.8	33	Primary metals
14.7	18.0	12.4	3.0	.4	.2	17.6	-	-	-	-	-	-	.2	331-32,3398-99	Ferrous metals and products
18.1	26.0	15.3	46.8	42.8	49.7	18.8	-	-	52.8	5.7	-	-	2.8	333-36	Nonferrous metals and products
27.7	32.6	24.9	1.7	-	4.6	23.4	47.2	92.8	76.8	39.2	2.0	-	21.9	34	Fabricated metal products
23.9	35.2	16.3	46.0	53.7	16.3	19.2	7.0	.5	1.2	32.2	25.2	-	2.8	35	Machinery
18.3	29.7	11.0	24.4	56.3	88.5	14.8	6.3	-	-	-	-	-	-	357	Office, computing, and accounting machines
34.8	36.0	43.3	69.6	33.3	-	29.7	37.3	16.4	1.2	33.8	25.2	-	11.8	351-56,358-59	Other machinery, except electrical
32.7	36.1	26.7	15.3	-	30.0	28.7	27.7	16.0	.3	1.5	2.7	.4	2.3	36	Electrical equipment
14.9	10.7	15.7	-	-	-	13.9	15.7	-	-	-	-	-	10.9	365	Radio and TV receiving equipment
25.2	26.6	28.2	10.2	-	25.8	23.5	53.3	47.0	-	-	-	-	.1	366	Communication equipment
53.5	63.9	51.5	56.6	-	37.4	55.8	15.4	100.0	100.0	19.4	42.5	.8	19.8	367	Electronic components
36.4	40.8	12.9	32.9	-	41.5	27.7	41.7	15.8	.6	1.4	1.5	-	2.1	361-64,369	Other electrical equipment
48.2	49.4	29.5	29.0	-	15.7	43.5	77.2	49.0	45.2	30.9	95.6	-	.2	371	Motor vehicles and motor vehicles equipment
43.3	30.7	46.7	52.2	2.1	-	3.0	18.0	7.3	6.0	12.3	4.4	-	-	373-75,379	Other transportation equipment
10.3	7.3	8.9	14.0	-	9.7	27.9	2.4	-	100.0	2.0	2.1	-	.4	372,376	Aircraft and missiles
64.7	52.4	66.1	15.9	70.1	74.8	54.5	85.6	95.6	-	4.9	29.6	-	2.1	38	Professional and scientific instruments
64.5	62.2	60.6	7.0	-	83.2	61.6	86.1	96.8	-	5.3	44.3	-	2.7	381-82	Scientific and mechanical measuring instruments
64.8	40.6	73.4	62.4	73.8	68.0	49.1	78.4	16.4	-	-	-	-	1.9	383-87	Optical, surgical, photographic, and other instruments
64.5	65.6	65.4	20.9	12.6	9.0	47.5	50.7	-	64.3	59.9	91.2	-	19.8	21,27,31,39	Other manufacturing industries
55.8	70.6	64.5	85.7	95.1	81.2	53.2	51.8	50.7	9.3	14.3	8.9	-	43.5	07-17,41-67 737,739,807,891	Nonmanufacturing industries

nonresponse. These nonsampling errors would also occur if a complete canvass were to be conducted under the same conditions as the survey (table A-2).

The forms for the survey were mailed in January 1982, and nonrespondents received followup letters by mail. Since total R&D performance funds, total Federal R&D funds, total net sales, and total employment are included in the Census Bureau's mandatory statistical program, the few companies that did not reply to Forms RD-1 or RD-1A for 1981 were mailed the Census Form MA-121, which collects these mandatory items.

In the absence of respondent-distributed data, the Bureau of the Census has estimated data for items as required in accordance with past performance and industry averages. Table A-1 shows imputation rates for many survey items.

comparability of data over a period of several years

In the survey of industrial research and development, there is substantial comparability over any 2-year period. Before mailing the survey forms each year, Census enters on each one the previous year's figures as reported by the respondent. The respondent is asked to adjust the data for the previous year as necessary to make it comparable to those data being reported for the current year. Such adjustments are made to reflect, for example, changes in reporting concepts or changes in company structure such as mergers or acquisitions. To maintain some measure of consistency, the employment-size classification of any company affected by such changes has been adjusted so that the company is tabulated in the same employment-size category for two consecutive years.

Some measure of the degree of change reflecting these adjustments in contrast to an actual change in R&D activity can be gained by comparing figures for the same year reported for two succeeding reporting periods, e.g., 1980 R&D statistics in the final report of the 1980 survey and the revised 1980 R&D statistics in the final report of the 1981 survey. The totals for broad classification are likely to be very close in the two reports; larger differences are noticeable in the finer detail. The results underscore the point that the measures are approximate and indicative rather than precise.

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Table A-2. Standard error of estimate (percentage) of funds for R&D performance for all company size-groups and for companies with less than 1,000 employees by industry: 1981

Industry	SIC code	Standard error[1]	Standard error of companies with less than 1,000 employees
Total	....	([2])	8
Food and kindred products	20	1	19
Textiles and apparel	22,23	3	22
Lumber, wood products, and furniture	24,25	1	20
Paper and allied products	26	1	34
Chemicals and allied products	28	1	8
Industrial chemicals	281-82,286	([2])	11
Drugs and medicines	283	3	15
Other chemicals	284-85,287-89	2	12
Petroleum refining and related industries	29	([2])	6
Rubber products	30	3	33
Stone, clay, and glass products	32	1	22
Primary metals	33	1	25
Ferrous metals and products	331-32,3398-99	1	29
Nonferrous metals and products	333-36	4	32
Fabricated metal products	34	4	25
Machinery	35	2	11
Office, computing, and accounting machines	357	1	13
Other machinery, except electrical	351-56,358-59	7	16
Electrical equipment	36	([2])	8
Radio and TV receiving equipment	365	1	20
Communication equipment	366	([2])	15
Electronic components	367	1	15
Other electrical equipment	361-64,369	([2])	9
Motor vehicles and motor vehicles equipment	371	([2])	20
Other transportation equipment	373-75,379	1	12
Aircraft and missiles	372,376	1	85
Professional and scientific instruments	38	1	15
Scientific and mechanical measuring instruments	381-82	3	22
Optical, surgical, photographic, and other instruments	383-87	1	11
Other manufacturing industries	21,27,31,39	2	18
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	7	25

[1] A description of the standard error of estimate is given in section A under "Methodology of Survey." The percentage (or relative) standard errors in this table may be converted to standard errors of estimate by multiplying the percentage shown by the associated estimate. For example, the relative standard error of estimate for R&D performance for all company size groups in the food and kindred products industry (SIC 20) is shown as 1 percent, and the associated total R&D estimate for this industry is shown as $719 million in table B-2, "Funds for research and development by industry and size of company: 1981." The standard error of estimate, then, is .01 times 719 or 7.19.

[2] Less than 0.5 percent.

industry codes for 1967-81[9]

The industry codes appearing in the tables are based on the 1972 Standard Industrial Classification (SIC) Manual. The SIC code for individual companies for individual companies for 1967-74 (which were utilized in the publications for those years) were originally determined by data reported in the 1967 Economic Censuses. The SIC classifications for individual comapnies for 1977-79 (which were utilized in the publications for those years) were originally determined by the 1974 SSEL file. Between 1967 and 1974 and again between 1977 and 1979, the SIC code for a company on the R&D survey generally remained fixed and reflected that company's principal activity as of 1967 or 1976. Under certain circumstances, however, such as the merger of two or more companies, the acquisition of one company by another, or the formation of "conglomerates," the 1967 or 1976 SIC code for a company could have changed. The Bureau of the Census could not be aware of a possible new SIC code for a company until the 1976 or 1981 new sample was drawn based upon the 1974 or 1981 SSEL file. (See above description of the new sample.) When the new sample was selected in each of the two years 1976 and 1981, the industry codes of companies in both the old and new panels were examined for possible change. The historical R&D tables (e.g., 1968-74 and 1977-79) have been adjusted to reflect the change in company activities. As it is not known normally when a company changed its industrial activities, the data were adjusted in the following fashion: for companies changing industry codes between 1967 and 1974, the industry total for each of the years affected (1968 through 1974) were estimated to have changed at a constant rate of 14.3 percent per year. Accordingly, the data for the industry in which such a company had been classified in 1967 were deflated by 14.3 percent per year for each of the years 1968-74 (e.g., 14.3 percent subtracted in 1968, 28.6 percent in 1977, 42.9 in 1970, etc.). Similarly, the data for the industry in which such a company was classified in 1974 were inflated by 14.3 percent per year for each of the years 1968-74.

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[9] For a discussion of industry codes for 1966 and earlier years, see National Science Foundation, *Research and Development in Industry, 1975. Funds, 1975; Scientists & Engineers, January 1976* (NSF 77-324) and *Research and Development in Industry, 1970. Funds, 1970; Scientists & Engineers, January 1971* (NSF 72-309) (Washington, D.C.: Supt. of Documents, U.S. Government Printing Office, 1978 and 1972.)

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To reflect changes in industry classification between 1976 and 1981, a nonlinear algorithm was used which is intended to link the two sample years while preserving the original year-to-year industry trend as much as possible. Estimates for 1976 remained unchanged since they were based on accurate classifications of companies at that time. Revised estimates for 1980 were formed based upon prior-period data that were collected in the new 1981 sample. Thus, the revised estimates reflect the most recent classification. Based on the 1976 estimates and the revised 1980 ones, estimates for each industry grouping for the years 1977, 1978, and 1979 were revised. A comparison of 1980 data collected from the previous sample and from the new sample (drawn in 1981) appears in table A-3.

The following measures were adjusted in the manner just described: Number of scientists and engineers; funds for research and development—total, Federal, and company; net sales; cost per R&D scientist or engineer; and basic research expenditures. Historical data for the other categories appear in selected tables of this publication. (See tables B-2, B-5, B-9, B-11, B-21, B-22, B-30, B-38, B-39, B-40, B-44, B-53, B-55, and B-59). No adjustments were made in data for other measures.

Table A-3. 1980 R&D funds as collected on the 1980 and 1981 R&D surveys[1]

[Dollars in millions]

Industry	SIC code	Total R&D			Reasons for revisions		
		1980 R&D from 1980 survey	1980 R&D from 1981 survey	Difference (B) - (A)	Industry shifts	Data revisions	New sample
		(A)	(B)	(C)	(D)	(E)	(F)
Total	....	43,879	44,505	+626	0	-33	+659
Food and kindred products	20	517	620	+103	0	0	+103
Textiles and apparel	22,23	102	115	+13	-1	+5	+9
Lumber, wood products, and furniture	24,25	165	148	-17	-17	0	0
Paper and allied products	26	508	495	-13	+5	0	-18
Chemicals and allied products	28	4,608	4,636	+28	-137	+8	+157
Industrial chemicals	281-82,286	2,273	2,197	-76	-170	+5	+89
Drugs and medicines	283	1,665	1,777	+112	0	+2	+110
Other chemicals	284-85,287-89	670	662	-8	+33	+1	-42
Petroleum refining and related industries	29	1,565	1,552	-13	-10	0	-3
Rubber products	30	646	656	+10	-1	0	+11
Stone, clay, and glass products	32	401	406	+5	-15	0	+20
Primary metals	33	693	728	+35	+39	0	-4
Ferrous metals and products	331-32,3398-99	318	443	+125	+130	0	-5
Nonferrous metals and products	333-36	375	285	-90	-91	0	+1
Fabricated metal products	34	588	550	-38	-35	0	-3
Machinery	35	6,076	5,901	-175	-281	+1	+105
Office, computing, and accounting machines	357	4,287	3,962	-325	-520	0	+195
Other machinery, except electrical	351-56,358-59	1,789	1,939	+150	+239	+1	-90
Electrical equipment	36	9,137	9,175	+38	-87	-48	+173
Radio and TV receiving equipment	365	89	556	+467	+448	0	+19
Communication equipment	366	4,510	4,024	-486	-505	-11	+30
Electronic components	367	1,354	1,547	+193	+61	-33	+165
Other electrical equipment	361-64,369	3,184	3,048	-136	-91	-4	-41
Motor vehicles and motor vehicles equipment	371	4,843	4,955	+112	+120	+13	-21
Other transportation equipment	373-75,379	155	162	+7	+2	0	+5
Aircraft and missiles	372,376	9,626	9,198	-428	-242	-153	-33
Professional and scientific instruments	38	2,270	3,029	+759	+593	+144	+22
Scientific and mechanical measuring instruments	381-82	735	1,352	+617	+604	+2	+11
Optical, surgical, photographic, and other instruments	383-87	1,535	1,677	+142	-11	+142	+11
Other manufacturing industries	21,27,31,39	410	364	-46	-7	-3	-36
Nonmanufacturing industries	07-17,41-67, 737,739,807,891	1,569	1,815	+246	+74	0	+172

[1] The difference between the two sets of 1980 estimates can be accounted for by companies which have switched industries (column D), companies which have revised their data (column E), and sampling variation (column F). Within column (F), $435 million is accounted for by estimating the growth factor for the RD-1A companies which was not reflected in the original 1980 survey (see technical notes).

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section b

statistical tables

In all tables of this report

- Details may not add to totals because of rounding.
- Percentages were calculated on the basis of thousands of dollars and may differ from those based on the rounded figures shown.
- Percentage changes are increases unless otherwise indicated.

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Table B-1. Trends in funds for industrial research and development by source: 1956-81

[Dollars in millions]

Year	Total R&D		Federal		Company[1]	
	Amount	Percent change from previous year	Amount	Percent of total	Amount	Percent of total
1956	$6,605	42	$3,328	50	$3,277	50
1957	7,731	17	4,335	56	3,396	44
1958	8,389	9	4,759	57	3,630	43
1959	9,618	15	5,635	59	3,983	41
1960	10,509	9	6,081	58	4,428	42
1961[2]	10,908	4	6,240	57	4,668	43
1962	11,464	5	6,434	56	5,029	44
1963	12,630	10	7,270	58	5,360	42
1964	13,512	7	7,720	57	5,792	43
1965	14,185	5	7,740	55	6,445	45
1966	15,548	10	8,332	54	7,216	46
1967	16,385	5	8,365	51	8,020	49
1968	17,429	6	8,560	49	8,869	51
1969	18,308	5	8,451	46	9,857	54
1970	18,067	-1	7,779	43	10,288	57
1971	18,320	1	7,666	42	10,654	58
1972	19,552	7	8,017	41	11,535	59
1973	21,249	9	8,145	38	13,104	62
1974	22,887	8	8,220	36	14,667	64
1975	24,187	6	8,605	36	15,582	64
1976	26,997	12	9,561	35	17,436	65
1977	29,825	10	10,485	35	19,340	65
1978	33,304	12	11,189	34	22,115	66
1979	38,226	15	12,518	33	25,708	67
1980	44,505	16	14,029	32	30,476	68
1981	51,830	16	16,468	32	35,362	68

[1] Company funds include all funds for industrial R&D work performed within company facilities except funds provided by the Federal Government. Excluded are company-financed research and development contracted to outside organizations such as research institutions, universities and colleges, or other nonprofit organizations.

[2] Funds by source estimated by the National Science Foundation.

SOURCE: National Science Foundation.

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Table B-2. Funds for research and development by industry and size of company: 1956, 1958, 1963, 1967, and 1970-81

[Dollars in millions]

Industry and size of company	SIC code	1956	1958	1963	1967	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
Total		$6,605	$8,389	$12,630	$16,385	$18,067	$18,320	$19,552	$21,249	$22,887	$24,187	$26,997	$29,825	$33,304	$38,226	$44,505	$51,830
Distribution by industry																	
Food and kindred products	20	64	83	130	183	230	240	259	269	298	335	355	415	472	528	620	719
Textiles and apparel	22,23	(1)	26	30	57	58	59	61	64	69	70	82	83	89	101	115	124
Lumber, wood products, and furniture	24,25	(1)	12	11	12	52	53	64	71	84	88	107	123	126	139	148	167
Paper and allied products	26	36	42	69	128	178	187	189	194	237	249	313	333	387	445	495	(1)
Chemicals and allied products	28	641	792	1,239	1,507	1,773	1,832	1,932	2,116	2,450	2,727	3,017	3,202	3,580	4,038	4,636	5,325
Industrial chemicals	281-82,286	460	553	809	966	1,031	1,009	1,031	1,119	1,299	1,391	1,524	1,668	1,798	1,962	2,197	2,553
Drugs and medicines	283	94	128	216	343	485	549	607	698	807	981	1,092	1,117	1,308	1,517	1,777	(1)
Other chemicals	284-85,287-89	87	111	214	198	257	274	294	299	344	354	401	417	474	559	562	(1)
Petroleum refining and related industries	29	182	246	317	371	515	505	468	498	622	693	767	918	1,060	1,262	1,552	(1)
Rubber products	30	(1)	89	156	182	276	289	377	426	469	467	502	491	493	577	656	(1)
Stone, clay, and glass products	32	[2]60	[2]75	100	136	167	164	183	199	217	233	263	287	324	356	406	(1)
Primary metals	33	90	131	183	242	275	272	277	307	358	443	506	538	560	634	728	889
Ferrous metals and products[3]	331-32,3398-99	(1)	80	106	135	149	144	146	163	181	215	256	284	314	375	443	(1)
Nonferrous metals and products[3]	333-36	(1)	51	77	107	126	128	130	145	177	228	250	254	246	259	285	(1)
Fabricated metal products	34	116	162	153	163	207	242	253	291	313	324	358	386	384	455	550	638
Machinery	35	543	781	958	1,326	1,729	1,860	2,158	2,549	2,985	3,196	3,487	3,880	4,283	4,825	5,901	6,800
Office, computing, and accounting machines	357	(4)	(4)	(4)	(4)	(4)	(4)	1,456	1,733	2,103	2,220	2,402	2,655	2,883	3,214	3,962	(1)
Other machinery, except electrical	351-56,358-59	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	1,225	1,400	1,611	1,939	(1)
Electrical equipment	36	1,516	1,969	2,868	2,867	4,220	4,389	4,680	4,902	5,011	5,105	5,636	5,886	6,507	7,824	9,175	10,466
Radio and TV receiving equipment	365	(6)	(6)	(6)	45	70	64	48	49	51	50	52	96	130	245	556	(1)
Communication equipment	366	(1)	868	1,773	2,425	2,604	2,731	2,583	2,613	2,424	2,385	2,511	2,725	2,999	3,635	4,024	4,737
Electronic components	367							330	406	489	549	691	770	902	1,169	1,547	1,659
Other electrical equipment	361-64,369	(1)	1,101	1,093	1,397	1,546	1,594	1,719	1,834	2,047	2,121	2,382	2,295	2,476	2,775	3,048	(1)
Motor vehicles and motor vehicles equipment	371	688	856	1,090	1,354	1,591	1,768	1,954	2,405	2,389	2,340	2,778	3,358	3,879	4,509	4,955	4,929
Other transportation equipment	373-75,379							56	72	87	90	94	120	131	159	162	(1)
Aircraft and missiles	372,376	2,138	2,609	4,712	5,669	5,219	4,881	4,950	5,052	5,278	5,713	6,339	7,033	7,536	8,041	9,198	11,702
Professional and scientific instruments	38	200	294	284	542	744	746	838	961	1,075	1,173	1,331	1,571	1,998	2,505	3,029	3,685
Scientific and mechanical measuring instruments	381-82	97	156	70	104	131	133	163	186	221	266	325	452	670	950	1,352	(1)
Optical, surgical, photographic, and other instruments	383-87	103	138	214	438	613	612	675	775	854	907	1,007	1,119	1,328	1,555	1,677	(1)
Other manufacturing industries	21,27,31,39	(1)	105	54	90	128	131	146	158	177	205	217	243	266	288	364	393
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	(1)	117	276	559	705	704	707	715	768	735	845	958	1,229	1,540	1,815	(1)
Distribution by size of company (based on number of employees)																	
Less than 1,000		369	532	619	687	904	884	929	940	1,058	1,222	1,384	1,353	1,438	1,764	2,065	2,522
1,000 to 4,999		[2]550	642	1,022	1,017	1,233	1,195	1,215	1,248	1,370	1,385	1,500	1,526	1,931	2,483	2,701	3,213
5,000 to 9,999		[2]5,686	7,215	10,989	892	1,095	1,170	1,076	1,168	1,346	1,478	1,648	1,829	1,551	1,691	2,028	2,425
10,000 to 24,999					13,790	14,835	15,071	2,159	2,236	2,416	2,633	2,874	3,418	4,278	5,191	6,017	6,938
25,000 or more								14,173	15,657	16,697	17,469	19,591	21,699	24,106	27,097	31,693	36,732

[1] Not separately available but included in total. See general notes.

[2] Estimated by the National Science Foundation.

[3] SIC codes 3398 and 3399 included in the nonferrous metals and products group for 1956-63.

[4] Data not tabulated at this level prior to 1972.

[5] Data not tabulated at this level prior to 1977.

[6] Included in the other electrical equipment group.

SOURCE: National Science Foundation.

Table B-3. Funds for research and development by industry and size of company: 1981

[Dollars in millions]

Industry	SIC code	Total	Companies with total employment of--				
			Less than 1,000	1,000 to 4,999	5,000 to 9,999	10,000 to 24,999	25,000 or more
Total	....	$51,830	$2,522	$3,213	$2,425	$6,938	$36,732
Food and kindred products	20	719	(1)	(1)	(1)	(1)	242
Textiles and apparel	22,23	124	(1)	(1)	(1)	38	21
Lumber, wood products, and furniture	24,25	167	11	(1)	25	(1)	55
Paper and allied products	26	(1)	(1)	61	23	(1)	321
Chemicals and allied products	28	5,325	210	520	518	1,877	2,201
Industrial chemicals	281-82,286	2,553	(1)	(1)	(1)	(1)	1,695
Drugs and medicines	283	(1)	(1)	(1)	(1)	(1)	304
Other chemicals	284-85,287-89	(1)	111	172	97	(1)	202
Petroleum refining and related industries	29	(1)	11	18	(1)	(1)	(1)
Rubber products	30	(1)	68	(1)	(1)	68	(1)
Stone, clay, and glass products	32	(1)	23	26	10	(1)	119
Primary metals	33	889	48	99	75	95	571
Ferrous metals and products	331-32,3398-99	(1)	(1)	(1)	(1)	(1)	(1)
Nonferrous metals and products	333-36	(1)	(1)	(1)	(1)	(1)	(1)
Fabricated metal products	34	638	(1)	(1)	(1)	(1)	(1)
Machinery	35	6,800	621	576	253	709	4,642
Office, computing, and accounting machines	357	(1)	(1)	(1)	(1)	(1)	(1)
Other machinery, except electrical	351-56,358-59	(1)	(1)	(1)	(1)	(1)	(1)
Electrical equipment	36	10,466	316	536	518	1,095	8,000
Radio and TV receiving equipment	365	(1)	(1)	(1)	(1)	(1)	457
Communication equipment	366	4,737	102	(1)	(1)	415	3,871
Electronic components	367	1,659	(1)	(1)	(1)	(1)	790
Other electrical equipment	361-64,369	(1)	(1)	(1)	80	267	2,882
Motor vehicles and motor vehicles equipment	371	4,929	(1)	(1)	(1)	(1)	4,625
Other transportation equipment	373-75,379	(1)	(1)	(1)	(1)	(1)	87
Aircraft and missiles	372,376	11,702	(1)	142	(1)	656	10,594
Professional and scientific instruments	38	3,685	299	267	180	615	2,324
Scientific and mechanical measuring instruments	381-82	(1)	(1)	172	(1)	228	972
Optical, surgical, photographic, and other instruments	383-87	(1)	(1)	95	(1)	387	1.352
Other manufacturing industries	21,27,31,39	393	43	80	64	82	(1)
Nonmanufacturing industries	07-17,41-67, 737,739,807,891	(1)	575	504	(1)	516	(1)

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-4. Funds for research and development by industry, size of company, and size of R&D program: 1981

Industry and size of company	SIC code	Total	R&D size of program [thousands of dollars]				
			Less than $200	$200 to $999	$1,000 to $9,999	$10,000 to $99,999	$100,000 or more
			[Dollars in millions]				
Total	....	$51,830	$489	$858	$3,272	$9,950	$37,261
Distribution by industry							
Food and kindred products	20	719	13	25	199	483	0
Textiles and apparel	22,23	124	13	20	63	28	0
Lumber, wood products, and furniture	24,25	167	8	15	50	95	0
Paper and allied products	26	(1)	(1)	14	65	224	256
Chemicals and allied products	28	5,325	49	47	306	1,880	3,044
Industrial chemicals	281-82,286	2,553	12	13	86	608	1,833
Drugs and medicines	283	(1)	(1)	12	63	917	1,009
Other chemicals	284-85,287-89	(1)	(1)	21	157	354	202
Petroleum refining and related industries	29	(1)	(1)	2	36	245	1,633
Rubber products	30	(1)	(1)	19	89	268	383
Stone, clay, and glass products	32	(1)	(1)	16	49	395	0
Primary metals	33	889	7	19	163	538	163
Ferrous metals and products	331-32,3398-99	(1)	(1)	14	77	299	163
Nonferrous metals and products	333-36	(1)	(1)	5	85	239	0
Fabricated metal products	34	638	24	65	145	404	0
Machinery	35	6,800	113	185	712	1,177	4,613
Office, computing, and accounting machines	357	(1)	(1)	31	186	591	3,687
Other machinery, except electrical	351-56,358-59	(1)	(1)	154	526	586	926
Electrical equipment	36	10,466	58	128	400	1,561	8,317
Radio and TV receiving equipment	365	(1)	(1)	17	28	96	457
Communication equipment	366	4,737	15	35	76	400	4,212
Electronic components	367	1,659	21	38	113	581	907
Other electrical equipment	361-64,369	(1)	(1)	38	184	485	2,742
Motor vehicles and motor vehicles equipment	371	4,929	5	16	27	323	4,558
Other transportation equipment	373-75,379	(1)	(1)	3	41	112	0
Aircraft and missiles	372,376	11,702	2	9	127	361	11,203
Professional and scientific instruments	38	3,685	34	109	349	442	2,751
Scientific and mechanical measuring instruments	381-82	(1)	(1)	74	215	294	1,078
Optical, surgical, photographic, and other instruments	383-87	(1)	(1)	35	134	148	1,673
Other manufacturing industries	21,27,31,39	393	15	35	99	246	0
Nonmanufacturing industries	07-17,41-67, 737,739,807,891	(1)	(1)	132	352	1,168	339
Distribution by size of company (based on number of employees)							
Less than 1,000	....	2,522	473	696	1,027	326	0
1,000 to 4,999	....	3,213	14	132	1,348	1,720	0
5,000 to 9,999	....	2,425	1	17	474	1,600	333
10,000 to 24,999	....	6,938	0	7	356	3,903	2,671
25,000 or more	....	36,732	1	4	69	2,401	34,257

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

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Table B-5. Company funds for research and development by industry and size of company: 1957-58, 1963, 1967, and 1970-81

[Dollars in millions]

Industry and size of company	SIC code	1957	1958	1963	1967	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
Total	....	$3,396	$3,630	$5,360	$8,020	$10,288	$10,654	$11,535	$13,104	$14,667	$15,582	$17,436	$19,340	$22,115	$25,708	$30,476	$35,362
Distribution by industry																	
Food and kindred products	20	74	77	(1)	181	227	238	258	268	297	(1)	(1)	(1)	(1)	(1)	(1)	713
Textiles and apparel	22,23	14	20	(1)	(1)	(1)	59	61	63	(1)	(1)	(1)	(1)	(1)	(1)	(1)	123
Lumber, wood products, and furniture	24,25	14	12	(1)	12	52	(1)	(1)	(1)	(1)	88	106	123	126	139	148	167
Paper and allied products	26	35	42	69	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	495	562
Chemicals and allied products	28	616	666	1,004	1,297	1,593	1,646	1,741	1,913	2,236	2,490	2,751	2,907	3,250	3,692	4,264	4,942
Industrial chemicals	281-82,286	423	443	662	785	873	850	860	936	1,105	1,173	1,275	1,387	1,473	1,617	1,856	2,186
Drugs and medicines	283	104	126	207	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	1,756	1,997
Other chemicals	284-85,287-89	89	97	135	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	653	759
Petroleum refining and related industries	29	200	234	296	355	493	488	454	485	603	(1)	715	842	939	1,109	1,401	1,777
Rubber products	30	70	68	111	160	205	221	255	280	(1)	(1)	(1)	(1)	(1)	(1)	(1)	616
Stone, clay, and glass products	32	(1)	(1)	97	134	156	153	168	184	203	(1)	(1)	(1)	(1)	(1)	363	411
Primary metals	33	103	117	174	234	265	266	264	297	350	422	481	494	497	539	594	707
Ferrous metals and products[2]	331-32,3398-99	63	78	105	134	148	142	144	159	(1)	211	252	261	271	305	338	414
Nonferrous metals and products[2]	333-36	40	39	69	100	117	124	121	138	(1)	211	229	233	226	234	256	293
Fabricated metal products	34	97	105	129	151	201	230	243	279	299	297	322	342	348	414	501	558
Machinery	35	397	438	709	1,004	1,469	1,545	1,758	2,120	2,473	2,687	2,955	3,403	3,901	4,490	5,254	6,061
Office, computing, and accounting machines	357	(3)	(3)	(3)	(3)	(3)	(3)	(1)	(1)	(1)	1,734	1,893	2,320	2,556	2,958	3,436	3,919
Other machinery, except electrical	351-56,358-59	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	1,183	1,345	1,532	1,818	2,142
Electrical equipment	36	608	632	1,017	1,571	2,008	2,131	2,313	2,491	2,704	2,798	3,081	3,238	3,741	4,515	5,431	6,502
Radio and TV receiving equipment	365	(5)	(5)	(5)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	52	85	102	192	346	364
Communication equipment	366	230	253	564	930	1,183	1,252	1,165	1,251	1,287	1,328	1,418	1,559	1,763	2,049	2,367	2,946
Electronic components	367							205	260	306	(1)	(1)	(1)	(1)	(1)	1,165	1,282
Other electrical equipment	361-64,369	378	379	453	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	1,553	1,910
Motor vehicles and motor vehicles equipment	371	517	560	799	994	1,278	1,461	1,661	2,020	2,101	2,022	2,395	2,887	3,381	3,780	4,300	4,295
Other transportation equipment	373-75,379							29	33	40	43	(1)	(1)	(1)	(1)	88	86
Aircraft and missiles	372,376	299	333	452	1,138	1,213	1,017	978	1,154	1,278	1,285	1,418	1,547	1,823	2,201	2,570	3,201
Professional and scientific instruments	38	140	157	202	353	550	583	678	801	908	1,001	1,168	1,350	1,668	2,012	2,456	3,047
Scientific and mechanical measuring instruments	381-82	59	63	53	67	111	120	151	175	211	251	309	405	560	747	1,001	1,285
Optical, surgical, photographic, and other instruments	383-87	81	94	149	286	439	463	527	626	697	750	859	945	1,108	1,265	1,454	1,762
Other manufacturing industries	21,27,31,39	19	33	52	88	(1)	(1)	(1)	(1)	(1)	198	212	204	266	288	339	393
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	(1)	55	85	172	225	252	277	299	305	425	471	541	702	859	1,037	1,199
Distribution by size of company (based on number of employees)																	
Less than 1,000	....	375	299	425	459	540	565	603	633	691	949	1,085	1,145	1,226	1,375	1,711	2,038
1,000 to 4,999	....	[6]406	[6]440	596	666	821	828	843	891	992	1,132	1,231	1,289	1,586	1,893	2,257	2,702
5,000 to 9,999	....	[6]2,615	[6]2,891	4,338	642	884	956	890	981	1,116	1,190	1,334	1,439	1,310	1,463	1,596	1,866
10,000 to 24,999	....				6,254	8,043	8,305	1,540	1,731	1,986	2,262	2,325	2,583	3,203	4,012	4,867	5,685
25,000 or more	....							7,659	8,868	9,882	10,049	11,461	12,884	14,790	16,965	20,045	23,071

Note: Company funds include all funds for industrial R&D work performed within company facilities except funds provided by the Federal Government. Excluded are company-financed research and development contracted to outside organizations such as research institutions, universities and colleges, or other nonprofit organizations.

[1] Not separately available but included in total. See general notes.
[2] SIC codes 3398 and 3399 included in the nonferrous metals and products group for 1957-63.
[3] Data not tabulated at this level prior to 1972.
[4] Data not tabulated at this level prior to 1977.
[5] Included in the other electrical equipment group.
[6] Estimated by the National Science Foundation.

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Table B-6. Company funds for research and development by industry and size of company: 1981

[Dollars in millions]

Industry	SIC code	Total	Companies with total employment of—				
			Less than 1,000	1,000 to 4,999	5,000 to 9,999	10,000 to 24,999	25,000 or more
Total	....	$35,362	$2,038	$2,702	$1,866	$5,685	$23,071
Food and kindred products	20	713	20	78	75	297	242
Textiles and apparel	22,23	123	18	26	20	38	21
Lumber, wood products, and furniture	24,25	167	11	(1)	25	(1)	(1)
Paper and allied products	26	562	(1)	61	23	139	(1)
Chemicals and allied products	28	4,942	199	519	517	1,861	1,846
Industrial chemicals	281-82,286	2,186	59	124	200	460	1,343
Drugs and medicines	283	1,997	(1)	223	221	1,221	(1)
Other chemicals	284-85,287-89	759	(1)	172	97	180	(1)
Petroleum refining and related industries	29	1,777	(1)	18	(1)	123	1,623
Rubber products	30	616	(1)	94	51	(1)	337
Stone, clay, and glass products	32	411	(1)	26	10	234	(1)
Primary metals	33	707	31	97	75	88	416
Ferrous metals and products	331-32,3398-99	414	(1)	46	(1)	30	286
Nonferrous metals and products	333-36	293	(1)	51	(1)	58	130
Fabricated metal products	34	558	89	88	95	84	203
Machinery	35	6,061	587	561	244	699	3,970
Office, computing, and accounting machines	357	3,919	186	255	83	279	3,116
Other machinery, except electrical	351-56,358-59	2,142	401	306	161	420	854
Electrical equipment	36	6,502	275	426	349	819	4,634
Radio and TV receiving equipment	365	364	29	21	(1)	(1)	(1)
Communication equipment	366	2,946	84	67	70	160	2,566
Electronic components	367	1,282	82	188	213	325	474
Other electrical equipment	361-64,369	1,910	81	150	(1)	(1)	(1)
Motor vehicles and motor vehicles equipment	371	4,295	13	21	30	139	4,093
Other transportation equipment	373-75,379	86	5	(1)	(1)	28	(1)
Aircraft and missiles	372,376	3,201	12	51	43	222	2,873
Professional and scientific instruments	38	3,047	293	246	156	426	1,926
Scientific and mechanical measuring instruments	381-82	1,285	185	160	76	(1)	(1)
Optical, surgical, photographic, and other instruments	383-87	1,762	108	87	80	(1)	(1)
Other manufacturing industries	21,27,31,39	393	43	80	64	82	125
Nonmanufacturing industries	07-17,41-67, 737,739,807,891	1,199	286	248	76	303	286

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-7. Company-financed research and development contracted to outside organizations by industry and size of company: 1981

[Dollars in millions]

Industry and size of company	SIC code	1981
Total		$621
Distribution by industry		
Food and kindred products	20	7
Textiles and apparel	22,23	1
Lumber, wood products, and furniture	24,25	2
Paper and allied products	26	13
Chemicals and allied products	28	152
Industrial chemicals	281-82,286	37
Drugs and medicines	283	91
Other chemicals	284-85,287-89	24
Petroleum refining and related industries	29	62
Rubber products	30	0
Stone, clay, and glass products	32	1
Primary metals	33	5
Ferrous metals and products	331-32,3398-99	3
Nonferrous metals and products	333-36	2
Fabricated metal products	34	1
Machinery	35	36
Office, computing, and accounting machines	357	18
Other machinery, except electrical	351-56,358-59	18
Electrical equipment	36	46
Radio and TV receiving equipment	365	(1)
Communication equipment	366	11
Electronic components	367	(1)
Other electrical equipment	361-64,369	29
Motor vehicles and motor vehicles equipment	371	(1)
Other transportation equipment	373-75,379	0
Aircraft and missiles	372,376	61
Professional and scientific instruments	38	2
Scientific and mechanical measuring instruments	381-82	2
Optical, surgical, photographic, and other instruments	383-87	0
Other manufacturing industries	21,27,31,39	(1)
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	57
Distribution by size of company (based on number of employees)		
Less than 1,000		3
1,000 to 4,999		23
5,000 to 9,999		25
10,000 to 24,999		131
25,000 or more		440

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

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Table B-8. Companies contracting research and development to outside organizations by industry and size of company: 1981

Industry	SIC code	Companies with total employment of--									
		Less than 1,000		1,000 to 4,999		5,000 to 9,999		10,000 to 24,999		25,000 or more	
		Total	Outside	Total	Outside	Total	Outside	Total	Outside	Total	Outside
Total		1,710	13	839	49	218	29	211	59	141	49
Food and kindred products	20	74	0	56	4	22	3	25	6	10	3
Textiles and apparel	22,23	46	1	46	1	14	0	12	3	4	1
Lumber, wood products, and furniture	24,25	36	0	36	0	9	1	3	0	2	1
Paper and allied products	26	21	0	33	2	6	1	10	4	6	3
Chemicals and allied products	28	187	7	62	12	15	5	24	11	11	6
Industrial chemicals	281-82,286	57	2	12	2	6	2	7	4	6	3
Drugs and medicines	283	31	2	15	4	3	1	11	5	4	2
Other chemicals	284-85,287-89	99	3	35	6	6	2	6	2	1	1
Petroleum refining and related industries	29	13	0	4	1	1	0	6	3	12	7
Rubber products	30	54	1	28	1	5	1	3	0	4	0
Stone, clay, and glass products	32	48	0	24	1	4	1	11	2	2	1
Primary metals	33	54	0	50	3	10	3	9	3	13	5
Ferrous metals and products	331-32,3398-99	28	0	34	3	6	3	5	1	10	3
Nonferrous metals and products	333-36	26	0	16	0	4	0	4	2	3	2
Fabricated metal products	34	105	0	48	3	15	3	6	1	4	1
Machinery	35	323	3	123	6	28	2	24	8	12	5
Office, computing, and accounting machines	357	76	1	20	0	3	0	5	0	6	3
Other machinery, except electrical	351-56,358-59	247	2	103	6	25	2	19	8	6	2
Electrical equipment	36	296	0	93	6	26	3	20	6	16	4
Radio and TV receiving equipment	365	26	0	7	0	1	0	2	1	1	0
Communication equipment	366	70	0	14	0	5	0	3	1	6	1
Electronic components	367	75	0	27	0	8	0	5	1	3	2
Other electrical equipment	361-64,369	125	0	45	6	12	3	10	3	6	1
Motor vehicles and motor vehicles equipment	371	30	0	19	0	6	0	6	0	6	2
Other transportation equipment	373-75,379	8	0	12	0	1	0	5	1	2	1
Aircraft and missiles	372,376	18	0	14	0	3	0	7	1	11	7
Professional and scientific instruments	38	210	1	40	2	11	4	6	1	6	0
Scientific and mechanical measuring instruments	381-82	113	0	21	0	5	3	3	1	3	0
Optical, surgical, photographic, and other instruments	383-87	97	1	19	2	6	1	3	0	3	0
Other manufacturing industries	21,27,31,39	63	0	53	3	16	1	9	2	6	1
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	124	0	98	4	26	1	25	7	14	1

SOURCE: National Science Foundation.

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Table B-9. Company research and development performed by foreign affiliates of U.S. domestic companies outside the United States by selected industry: 1974-81

[Dollars in millions]

Industry	SIC code	1974[1]	1975	1976	1977	1978	1979	1980	1981
Total	....	$1,300	$1,454	$1,659	$1,877	$2,209	$2,754	$3,165	$3,157
Food and kindred products	20	27	23	29	32	43	51	54	66
Chemicals and allied products	28	208	269	312	332	395	500	603	651
Industrial and other chemicals	281-82,284-89	82	85	108	133	151	199	245	275
Drugs and medicines	283	126	184	204	199	244	301	357	376
Petroleum refining and related industries	29	([2])	([2])	([2])	([2])	([2])	([2])	141	192
Stone, clay, and glass products	32	7	7	([2])	([2])	([2])	([3])	21	15
Primary metals	33	3	9	12	9	9	11	11	9
Fabricated metal products	34	([2])	([2])	22	24	29	([3])	([3])	([3])
Machinery	35	258	331	352	411	480	534	599	585
Electrical equipment	36	238	245	278	300	352	445	451	455
Electronic components	367	4	7	9	13	17	25	29	47
Other electrical equipment	361-64,369	([3])	([3])	6	5	9	11	11	12
Radio and TV receiving equipment; communication equipment	365-66	([3])	([3])	([3])	([3])	([3])	([3])	([3])	([3])
Transportation	37	406	412	464	558	640	874	1,020	893
Motor vehicles and other transportation equipment	371,373-375,379	364	373	423	514	([3])	([3])	([3])	([3])
Aircraft and missiles	372,376	42	39	41	44	([3])	([3])	([3])	([3])
Professional and scientific instruments	38	39	49	49	51	61	76	86	101
Other manufacturing industries	21-27,30-31,39	111	105	137	144	181	213	139	147
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	3	4	4	9	12	5	7	12

[1] Based on data obtained from the top 200 U.S. R&D performing companies.
[2] Included in the other manufacturing industries group.
[3] Not separately available but included in total. See general notes.

Note: Data are reported in current U.S. dollars.

SOURCE: National Science Foundation

Table B-10. Company funds for R&D performance by selected industry: 1981 actual and 1982 projected

[Dollars in millions]

Industry	SIC code	Actual 1981	1982 (projected)
Total	....	$35,362	$42,142
Chemicals and allied products	28	4,942	4,743
Industrial chemicals	281-82,286	2,186	1,852
Machinery	35	6,061	7,209
Electrical equipment	36	6,502	7,457
Communication equipment	366	2,946	3,575
Motor vehicles and motor vehicles equipment	371	4,295	4,204
Aircraft and missiles	372,376	3,201	3,964

SOURCE: National Science Foundation.

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Table B-11. Federal funds for research and development by industry and size of company: 1957-58, 1963, 1967, and 1970-81

[Dollars in millions]

Industry and size of company	SIC code	1957	1958	1963	1967	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
Total	....	$4,335	$4,759	$7,270	$8,365	$7,779	$7,666	$8,017	$8,145	$8,220	$8,605	$9,561	$10,485	$11,189	$12,518	$14,029	$16,468
Distribution by industry																	
Food and kindred products	20	(1)	6	(2)	2	3	2	1	1	1	(2)	(2)	(2)	(2)	(2)	(2)	6
Textiles and apparel[3]	22, 23	(3)	(3)	(2)	(2)	(2)	1	1	1	(2)	(2)	(2)	(2)	(2)	(2)	(2)	1
Lumber, wood products, and furniture[3]	24, 25	(3)	(3)	(2)	0	0	(2)	(2)	(2)	(2)	0	0	0	0	0	(2)	0
Paper and allied products	26	(1)	0	0	(2)	(2)	(2)	2	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Chemicals and allied products	28	89	126	234	210	180	184	189	203	214	236	266	295	330	346	372	383
Industrial chemicals	281-82, 286	80	110	146	181	158	159	171	183	194	218	249	281	325	345	341	367
Drugs and medicines	283	(1)	2	9	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Other chemicals	284-85, 287-89	9	14	79	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Petroleum refining and related industries	29	11	12	21	16	22	17	15	14	20	(2)	52	76	121	153	151	(2)
Rubber products	30	37	21	46	22	71	69	123	146	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Stone, clay, and glass products	32	(2)	(2)	3	2	11	10	14	15	14	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Primary metals	33	5	14	10	8	10	6	12	11	8	21	26	44	63	95	135	182
Ferrous metals and products[4]	331-32, 3398-99	1	2	2	1	1	2	3	4	(2)	3	4	23	43	70	105	(2)
Nonferrous metals and products[4]	333-36	4	12	8	6	9	4	10	7	(2)	17	22	21	20	25	30	(2)
Fabricated metal products	34	38	57	24	13	7	11	12	13	14	27	36	44	36	41	49	80
Machinery	35	272	343	250	322	262	315	401	429	511	509	532	477	382	335	647	739
Office, computing, and accounting machines	357	(5)	(5)	(5)	(5)	(5)	(5)	(2)	(2)	(2)	486	509	435	327	256	(2)	(2)
Other machinery, except electrical	351-36, 358-59	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	42	55	79	(2)	(2)
Electrical equipment	36	1,196	1,337	1,849	2,296	2,211	2,258	2,367	2,410	2,307	2,307	2,555	2,648	2,766	3,309	3,744	3,962
Radio and TV receiving equipment	365	(7)	(7)	(7)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	0	11	28	53	210	(2)
Communication equipment	366	518	615	1,209	1,495	1,420	1,479	1,417	1,362	1,137	1,057	1,093	1,166	1,236	1,586	1,657	1,791
Electronic components	367							125	146	184	(2)	(2)	(2)	(2)	(2)	382	376
Other electrical equipment	361-64, 369	678	722	640	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	1,495	(2)
Motor vehicles and motor vehicles equipment	371	190	296	291	360	314	309	293	385	288	318	383	471	498	729	655	634
Other transportation equipment	373-75, 379							26	39	47	47	(2)	(2)	(2)	(2)	(2)	(2)
Aircraft and missiles	372, 376	2,275	2,276	4,261	4,531	4,005	3,864	3,970	3,899	4,000	4,428	4,921	5,486	5,713	5,840	6,628	8,501
Professional and scientific instruments	38	109	137	81	189	194	164	161	160	167	172	163	221	330	493	573	638
Scientific and mechanical measuring instruments	381-82	80	93	16	37	20	14	13	11	10	15	15	47	110	203	350	(2)
Optical, surgical, photographic, and other instruments	383-87	29	44	65	152	174	150	148	149	157	157	148	174	220	290	223	(2)
Other manufacturing industries	21, 27, 31, 39	74	72	3	(2)	(2)	(2)	(2)	(2)	(2)	7	5	39	0	0	25	0
Nonmanufacturing industries[3]	07-17, 41-67, 737, 739, 807, 891	0	62	190	387	480	452	431	416	463	310	375	417	527	681	779	(2)
Distribution by size of company (based on number of employees)																	
Less than 1,000	....	167	233	194	228	364	318	326	307	367	273	299	208	212	389	354	484
1,000 to 4,999	....	226	[8]202	425	351	412	367	372	357	378	253	270	237	345	590	444	511
5,000 to 9,999	....	3,942	[8]4,324	6,651	251	211	214	186	187	230	288	313	390	241	228	432	559
10,000 to 24,999	....				7,536			619	505	430	371	548	835	1,075	1,179	1,150	1,253
25,000 or more	....					6,792	6,766	6,514	6,789	6,815	7,420	8,130	8,815	9,316	10,132	11,648	13,661

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[1] Less than $0.5 million.

[2] Not separately available but included in total. See general notes.

[3] For 1957 and 1958 textiles and apparel and lumber, wood products, and furniture are included in the nonmanufacturing industries group.

[4] SIC codes 3398 and 3399 included in the nonferrous metals and products group for 1957-63.

[5] Data not tabulated at this level prior to 1972.

[6] Data not tabulated at this level prior to 1977.

[7] Included in the other electrical equipment group.

[8] Estimated by the National Science Foundation.

SOURCE: National Science Foundation.

Table B-12. Federal funds for research and development by industry and size of company: 1981

[Dollars in millions]

Industry	SIC code	Total	Companies with total employment of--				
			Less than 1,000	1,000 to 4,999	5,000 to 9,999	10,000 to 24,999	25,000 or more
Total	....	$16,468	$484	$511	$559	$1,253	$13,661
Food and kindred products	20	6	(1)	(1)	(1)	(1)	0
Textiles and apparel	22,23	1	(1)	(1)	(1)	0	0
Lumber, wood products, and furniture	24,25	0	0	0	0	0	0
Paper and allied products	26	(1)	0	0	0	(1)	(1)
Chemicals and allied products	28	383	11	1	1	16	355
Industrial chemicals	281-82,286	367	(1)	(1)	(1)	(1)	352
Drugs and medicines	283	(1)	(1)	(1)	(1)	(1)	(1)
Other chemicals	284-85,287-89	(1)	(1)	0	0	(1)	(1)
Petroleum refining and related industries	29	(1)	(1)	0	0	(1)	(1)
Rubber products	30	(1)	(1)	(1)	(1)	(1)	(1)
Stone, clay, and glass products	32	(1)	(1)	0	0	(1)	(1)
Primary metals	33	182	17	2	0	7	156
Ferrous metals and products	331-32,3398-99	(1)	0	(1)	0	(1)	(1)
Nonferrous metals and products	333-36	(1)	17	(1)	0	(1)	(1)
Fabricated metal products	34	80	(1)	(1)	(1)	(1)	(1)
Machinery	35	739	34	15	9	11	671
Office, computing, and accounting machines	357	(1)	(1)	(1)	(1)	(1)	(1)
Other machinery, except electrical	351-56,358-59	(1)	(1)	(1)	(1)	(1)	(1)
Electrical equipment	36	3,962	41	110	169	276	3,366
Radio and TV receiving equipment	365	(1)	(1)	(1)	0	0	(1)
Communication equipment	366	1,791	18	(1)	(1)	255	1,305
Electronic components	367	376	(1)	(1)	(1)	(1)	316
Other electrical equipment	361-64,369	(1)	(1)	(1)	(1)	(1)	(1)
Motor vehicles and motor vehicles equipment	371	634	(1)	(1)	(1)	(1)	532
Other transportation equipment	373-75,379	(1)	(1)	0	0	(1)	(1)
Aircraft and missiles	372,376	8,501	(1)	92	(1)	434	7,721
Professional and scientific instruments	38	638	6	20	24	190	398
Scientific and mechanical measuring instruments	381-82	(1)	(1)	12	(1)	(1)	(1)
Optical, surgical, photographic, and other instruments	383-87	(1)	(1)	8	(1)	(1)	(1)
Other manufacturing industries	21,27,31,39	0	0	0	0	0	0
Nonmanufacturing industries	07-17, 41-67, 737,739,807,891	(1)	289	256	(1)	213	(1)

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

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Table B-13. Federal funds for research and development by selected industry and agency: 1963-77, 1979, and 1981

[Dollars in millions]

Industry	SIC code	1963	1964	1965	1966	1967	1968	1969	1970	1971	19[illegible]	1973	1974	1975	1976	1977	1979	1981
Total		$7,270	$7,720	$7,740	$8,332	$8,365	$8,560	$8,451	$7,779	$7,666	$8,017	$8,145	$8,220	$8,605	$9,561	$10,485	$12,518	$16,468
Chemicals and allied products	28	234	202	191	188	210	199	192	180	184	189	203	214	236	266	295	346	383
Machinery	35	250	246	239	286	322	340	260	262	315	401	429	511	509	532	477	335	739
Electrical equipment	36	1,849	1,873	1,983	2,201	2,296	2,333	2,390	2,211	2,258	2,367	2,410	2,307	2,307	2,555	2,648	3,309	3,962
Motor vehicles and other transportation equipment	371,373-75,379	291	322	325	344	360	374	290	314	309	319	424	335	365	(1)	(1)	(1)	(1)
Aircraft and missiles	372,376	4,261	4,621	4,499	4,724	4,531	4,533	4,524	4,005	3,864	3,970	3,889	4,003	4,434	4,930	5,486	5,840	8,501
Other industries	--	385	456	503	589	646	781	795	807	736	771	790	850	754	(1)	(1)	(1)	(1)
DOD[2]																		
Total		$4,700	$4,192	$3,808	$4,241	$5,144	$5,427	$5,688	$5,288	$5,315	$5,818	$6,088	$5,919	$5,812	$6,222	$6,950	$7,939	$10,540
Chemicals and allied products	28	(1)	104	63	53	64	64	49	35	40	40	48	39	27	28	38	52	54
Machinery	35	148	132	147	227	228	192	182	186	201	250	302	426	405	442	395	541	599
Electrical equipment	36	1,200	1,720	1,130	1,292	1,437	1,517	1,584	1,484	1,503	1,663	1,770	1,643	1,570	1,607	1,692	1,920	2,338
Motor vehicles and other transportation equipment	371,373-75,379	(1)	194	221	229	261	270	242	272	246	232	325	251	288	337	382	(1)	(1)
Aircraft and missiles	372,376	2,700	2,389	2,006	2,239	2,745	2,811	3,050	2,771	2,848	3,084	3,077	2,992	3,120	3,408	3,900	4,210	6,121
Other industries	--	(1)	253	241	201	409	573	581	540	477	549	566	568	402	400	461	(1)	(1)
NASA[2]																		
Total		$1,800	$2,725	$3,166	$3,233	$2,300	$2,311	$1,868	$1,421	$1,391	$1,111	$982	$1,095	$1,409	$1,604	$1,697	$1,786	$2,306
Chemicals and allied products	28	(1)	2	1	1	2	5	5	1	3	1	1	(1)	(1)	(1)	(1)	(1)	(1)
Machinery	35	(1)	91	101	129	79	99	79	78	79	81	78	63	62	62	54	74	81
Electrical equipment	36	300	264	468	497	404	423	336	274	298	222	181	162	186	200	208	252	317
Motor vehicles and other transportation equipment	371,373-75,379	(1)	120	98	97	87	82	33	33	48	58	45	25	27	(1)	(1)	(1)	(1)
Aircraft and missiles	372,376	1,400	2,084	2,340	2,291	1,595	1,555	1,285	949	898	694	617	789	1,082	1,267	1,348	1,221	1,785
Other industries	--	(1)	165	163	220	133	147	132	87	65	55	60	(1)	(1)	45	44	119	70
DOE																		
Total		(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	$1,575	$1,976
Chemicals and allied products	28	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(1)	(1)
Machinery	35	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(1)	(1)
Electrical equipment	36	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	784	951
Motor vehicles and other transportation equipment	371,373-75,379	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	16	20
Aircraft and missiles	372,376	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	253	340
Other industries	--	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	287	356

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[1] Not separately available but included in total. See general notes.

[2] For 1963 to 1974 these funds were based on approximately 175 companies leading in Federal R&D funds; 1975 to 1981 funds are based on all companies reporting Federal R&D funds.

[3] Data not tabulated for this agency prior to 1979.

SOURCE: National Science Foundation.

Table B-14. R&D-performing companies with Federal R&D funds by industry and size of company: 1981

Industry	SIC code	Companies with total employment of--									
		Less than 1,000		1,000 to 4,999		5,000 to 9,999		10,000 to 24,999		25,000 or more	
		Total	Federal	Total	Federal	Total	Federal	Total	Federal	Total	Federal
Total........................	....	1,710	87	839	71	218	37	211	55	141	82
Food and kindred products..........	20	74	1	56	2	22	3	25	1	10	0
Textiles and apparel...............	22, 23	46	2	46	2	14	1	12	0	4	0
Lumber, wood products, and furniture.........................	24, 25	36	0	36	1	9	0	3	0	2	1
Paper and allied products..........	26	21	0	33	0	6	0	10	1	6	1
Chemicals and allied products......	28	187	5	62	2	15	3	24	7	11	8
Industrial chemicals............	281-82, 286	57	2	12	1	6	2	7	4	6	6
Drugs and medicines.............	283	31	1	15	1	3	1	11	1	4	2
Other chemicals.................	284-85, 287-89	99	2	35	0	6	0	6	2	1	0
Petroleum refining and related industries........................	29	13	1	4	0	1	0	6	3	12	10
Rubber products....................	30	54	2	28	3	5	1	3	1	4	4
Stone, clay, and glass products....	32	48	1	24	0	4	0	11	3	2	1
Primary metals.....................	33	54	1	50	6	10	0	9	3	13	7
Ferrous metals and products......	331-32, 3398-99	28	0	34	3	6	0	5	1	10	4
Nonferrous metals and products...	333-36	26	1	16	3	4	0	4	2	3	3
Fabricated metal products..........	34	105	2	48	2	15	1	6	3	4	2
Machinery..........................	35	323	9	123	6	28	3	24	6	12	6
Office, computing, and accounting machines.......................	357	76	2	20	1	3	0	5	1	6	3
Other machinery, except electrical.....................	351-56, 358-59	247	7	103	5	25	3	19	5	6	3
Electrical equipment...............	36	296	21	93	13	26	10	20	6	16	13
Radio and TV receiving equipment.	365	26	2	7	1	1	0	2	0	1	1
Communication equipment..........	366	70	9	14	6	5	4	3	2	6	5
Electronic components............	367	75	3	27	3	8	4	5	2	3	3
Other electrical equipment.......	361-64, 369	125	7	45	3	12	2	10	2	6	4
Motor vehicles and motor vehicles equipment.........................	371	30	2	19	2	6	3	6	2	6	6
Other transportation equipment.....	373-75, 379	8	1	12	0	1	0	5	1	2	2
Aircraft and missiles..............	372, 376	18	1	14	6	3	2	7	6	11	11
Professional and scientific instruments.......................	38	210	7	40	11	11	3	6	3	6	5
Scientific and mechanical measuring instruments...........	381-82	113	3	21	7	5	2	3	2	3	3
Optical, surgical, photographic, and other instruments...........	383-87	97	4	19	4	6	1	3	1	3	2
Other manufacturing industries.....	21, 27, 31, 39	63	3	53	0	16	0	9	0	6	1
Nonmanufacturing industries........	{ 07-17, 41-67, 737, 739, 807, 891 }	124	28	98	15	26	7	25	9	14	4

SOURCE: National Science Foundation.

Table B-15. Industry-administered federally funded research and development centers--composition of work force and funds by character of work: 1980-81

[Dollars in millions]

Item	1980	1981
Total R&D funds[1]	$1,277	$1,387
Basic research	(2)	126
Applied research	(2)	301
Development	(2)	959
	January	
	1981	1982
Full-time-equivalent R&D scientists and engineers	9,499	8,470
	March	
	1980	1981
Total employment	28,085	24,768

[1] All of these funds were devoted to Federal R&D activities.

[2] Data not collected for 1980.

SOURCE: National Science Foundation.

Table B-16. R&D-performing companies in manufacturing and nonmanufacturing industries by size of company: 1981

Size of company (based on number of employees)	Number of companies reporting R&D funds		
	Total	Manufacturing	Nonmanufacturing
Total	13,909	(1)	(1)
Less than 1,000	[2]12,500	(1)	(1)
1,000 to 4,999	839	741	98
5,000 to 9,999	218	192	26
10,000 to 24,999	211	186	25
25,000 or more	141	127	14

[1] Not separately available but included in total. See general notes.

[2] Estimated by the Census Bureau based on the 1981 survey of companies with fewer than 1,000 employees. This figure is not comparable to estimates published in earlier volumes due to a change in the estimating procedure used to derive this number.

SOURCE: National Science Foundation

Table B-17. R&D-performing companies by size of company and R&D program: 1981

Size of company (based on number of employees)	Total	Size of R&D program [Dollars in thousands]				
		Less than $200	$200 to $999	$1,000 to $9,999	$10,000 to $99,999	$100,000 or more
Total	3,119	1,043	820	859	315	82
Less than 1,000	1,710	889	534	275	11	1
1,000 to 4,999	839	126	235	396	82	0
5,000 to 9,999	218	18	33	105	59	3
10,000 to 24,999	211	5	13	67	109	17
25,000 or more	141	5	5	16	54	61

SOURCE: National Science Foundation.

Table B-18. R&D-performing manufacturing companies with 5,000 or more employees by industry and percent change in R&D funds: 1980-81

Industry	SIC code	Total number of companies	10 percent or more increase	10 percent or more decrease	Less than 10 percent change
Total	....	505	307	42	156
Food and kindred products	20	57	37	2	18
Textiles and apparel	22,23	30	7	5	18
Lumber, wood products, and furniture	24,25	14	8	2	4
Paper and allied products	26	22	13	2	7
Chemicals and allied products	28	50	33	1	16
Industrial chemicals	281-82,286	19	13	0	6
Drugs and medicines	283	18	15	0	3
Other chemicals	284-85,287-89	13	5	1	7
Petroleum refining and related industries	29	19	15	2	2
Rubber products	30	12	6	0	6
Stone, clay, and glass products	32	17	7	1	9
Primary metals	33	32	22	5	5
Ferrous metals and products	331-32,3398-99	21	14	4	3
Nonferrous metals and products	333-36	11	8	1	2
Fabricated metal products	34	25	17	3	5
Machinery	35	64	44	3	17
Office, computing, and accounting machines	357	14	9	0	5
Other machinery, except electrical	351-56,358-59	50	35	3	12
Electrical equipment	36	62	42	5	15
Radio and TV receiving equipment	365	4	1	2	1
Communication equipment	366	14	9	0	5
Electronic components	367	16	13	1	2
Other electrical equipment	361-64,369	28	19	2	7
Motor vehicles and motor vehicles equipment	371	18	8	2	8
Other transportation equipment	373-75,379	8	6	1	1
Aircraft and missiles	372,376	21	11	1	9
Professional and scientific instruments	38	23	17	2	4
Scientific and mechanical measuring instruments	381-82	11	8	1	2
Optical, surgical, photographic, and other instruments	383-87	12	9	1	2
Other manufacturing industries	21,27,31,39	31	14	5	12

Note Manufacturing companies with 5,000 or more employees are classified into those increasing 10 percent or more, those decreasing 10 percent or more, or those changing less than 10 percent based on their ratio of change for total R&D funds between 1980 and 1981.

SOURCE: National Science Foundation.

Table B-19. Percent of total, Federal, and company funds of R&D-performing companies ranked by size of R&D program: 1972-81

Companies ranked by size of R&D program (based on total R&D funds)[1]	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
	Percent of total R&D funds									
First 4 (1-4)	18	19	20	20	20	20	19	20	17	19
Next 4 (5-8)	16	15	15	15	14	14	14	13	14	12
Next 12 (9-20)	21	22	21	19	20	19	19	19	18	19
Next 20 (21-40)	12	11	11	12	12	13	13	13	13	13
Next 60 (41-100)	13	13	15	15	15	15	15	15	15	15
Next 100 (101-200)	7	8	8	8	8	9	9	9	9	9
Next 200 (201-400)	6	6	6	6	6	6	6	6	6	6
	Percent of Federal R&D funds									
First 4 (1-4)	10	10	19	21	19	20	17	10	14	20
Next 4 (5-8)	32	31	22	23	23	23	24	27	20	17
Next 12 (9-20)	29	30	31	29	30	30	31	34	32	31
Next 20 (21-40)	16	15	11	12	11	12	11	11	15	13
Next 60 (41-100)	7	7	9	9	12	12	13	12	12	12
Next 100 (101-200)	2	3	4	4	3	3	4	4	4	4
Next 200 (201-400)	3	3	2	2	2	1	1	2	3	3
	Percent of company R&D funds									
First 4 (1-4)	24	25	20	19	20	20	20	24	18	18
Next 4 (5-8)	5	5	11	10	9	8	9	7	11	10
Next 12 (9-20)	15	15	13	13	13	13	13	12	12	13
Next 20 (21-40)	9	9	11	11	12	13	13	14	12	12
Next 60 (41-100)	17	17	17	17	17	16	16	17	17	17
Next 100 (101-200)	11	11	11	10	11	12	11	11	11	11
Next 200 (201-400)	8	8	8	8	8	8	8	8	8	8

[1] Companies were ranked individually for each year; therefore, particular companies comprising the size groups may have changed from year to year.

SOURCE: National Science Foundation.

Table B-20. Net sales of R&D-performing companies by industry and size of company: 1980-81

[Dollars in millions]

Industry	SIC code	1980						1981					
		Total	Companies with total employment of--					Total	Companies with total employment of--				
			Less than 1,000	1,000 to 4,999	5,000 to 9,999	10,000 to 24,999	25,000 or more		Less than 1,000	1,000 to 4,999	5,000 to 9,999	10,000 to 24,999	25,000 or more
Total	....	$1,610,882	$146,268	$156,472	$151,838	$358,829	$797,476	$1,786,172	$144,512	$175,900	$162,773	$378,327	$924,659
Food and kindred products	20	155,676	9,623	19,025	26,002	65,321	35,705	177,057	10,522	21,925	25,770	78,570	40,271
Textiles and apparel	22,23	29,052	2,539	4,812	5,045	9,402	7,254	30,023	2,920	5,390	5,359	9,504	6,851
Lumber, wood products, and furniture	24,25	18,899	1,832	4,566	3,758	3,670	([1])	19,576	1,783	4,895	([1])	3,688	([1])
Paper and allied products	26	49,263	2,508	7,090	2,851	15,277	21,539	53,652	2,739	7,904	3,260	16,787	22,962
Chemicals and allied products	28	129,190	9,823	14,848	15,096	37,947	51,476	141,254	11,208	16,193	15,938	41,720	56,195
Industrial chemicals	281-82,286	67,054	3,111	4,545	8,521	15,101	35,776	73,042	3,469	4,876	8,888	16,442	39,366
Drugs and medicines	283	28,575	904	3,245	2,199	14,429	([1])	31,461	1,048	3,418	([1])	15,985	([1])
Other chemicals	284-85,287-89	33,560	5,808	7,058	4,375	8,417	([1])	36,750	6,690	7,899	([1])	9,293	([1])
Petroleum refining and related industries	29	258,980	2,036	4,310	([1])	43,689	206,821	286,867	2,429	5,426	([1])	41,675	234,805
Rubber products	30	29,400	4,154	4,494	2,436	5,409	12,908	32,162	4,642	5,246	2,588	5,904	13,781
Stone, clay, and glass products	32	28,670	4,009	3,276	2,843	12,737	([1])	29,189	3,348	3,731	([1])	13,363	([1])
Primary metals	33	109,034	4,675	12,408	21,964	12,031	57,956	115,147	3,818	13,075	21,473	12,737	64,045
Ferrous metals and products	331-32,3398-99	65,996	2,100	7,625	4,953	5,173	46,145	72,101	1,706	8,317	([1])	([1])	52,614
Nonferrous metals and products	333-36	43,038	2,575	4,783	17,012	6,858	11,811	43,046	2,111	4,758	([1])	([1])	11,431
Fabricated metal products	34	40,126	7,581	7,529	6,691	6,457	11,868	44,564	8,040	8,125	7,835	6,950	13,614
Machinery	35	117,173	19,911	19,922	12,186	21,409	43,745	131,862	19,373	21,439	13,408	26,783	50,858
Office, computing, and accounting machines	357	33,129	2,178	2,062	1,002	4,213	23,674	38,660	2,330	2,584	951	5,104	27,692
Other machinery, except electrical	351-56,358-59	84,044	17,733	17,860	11,184	17,196	20,071	93,201	17,043	18,855	12,457	21,680	23,166
Electrical equipment	36	139,261	8,060	10,736	9,235	21,783	89,448	154,183	9,001	12,831	11,069	23,358	97,925
Radio and TV receiving equipment	365	13,020	880	767	([1])	([1])	([1])	13,733	904	881	([1])	([1])	([1])
Communication equipment	366	44,053	1,489	1,050	([1])	([1])	36,746	49,106	1,820	1,319	([1])	([1])	40,033
Electronic components	367	19,584	1,996	2,803	2,886	3,379	([1])	22,548	2,482	3,277	3,760	([1])	([1])
Other electrical equipment	361-64,369	62,605	3,695	6,116	4,872	10,670	37,252	68,795	3,793	7,354	5,199	11,460	40,989
Motor vehicles and motor vehicles equipment	371	101,642	1,453	2,577	4,027	9,122	84,462	110,540	1,336	2,889	4,303	7,910	94,102
Other transportation equipment	373-75,379	28,388	511	2,483	([1])	2,549	([1])	30,800	549	2,715	([1])	2,752	([1])
Aircraft and missiles	372,376	67,302	616	1,557	2,051	7,298	55,780	76,405	697	1,846	2,174	8,491	63,196
Professional and scientific instruments	38	40,438	5,210	4,285	4,698	5,607	20,638	44,736	5,959	4,654	4,567	6,457	23,099
Scientific and mechanical measuring instruments	381-82	16,116	2,941	2,231	1,707	3,120	([1])	18,243	3,500	2,340	([1])	3,762	([1])
Optical, surgical, photographic, and other instruments	383-87	24,322	2,269	2,054	2,991	2,487	([1])	26,473	2,458	2,315	([1])	2,695	([1])
Other manufacturing industries	21,27,31,39	85,065	33,749	6,937	11,246	10,891	22,243	91,321	34,175	7,888	13,548	11,247	24,463
Nonmanufacturing industries	{07-17,41-67,737, 739,807,891}	183,323	27,979	25,616	19,289	68,230	42,209	216,834	21,975	29,729	21,745	60,433	82,952

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-21. R&D funds as a percent of net sales in R&D-performing manufacturing companies by industry and size of company: 1957-58, 1963, 1967, and 1970-81

Industry and size of company	SIC code	1957	1958	1963	1967	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
Total	....	3.4	3.8	4.5	4.2	3.7	3.5	3.4	3.3	3.1	3.1	3.1	2.9	2.9	2.6	3.0	3.2
Distribution by industry																	
Food and kindred products	20	.3	.3	.4	.5	.5	.5	.4	.4	.4	.4	.4	.4	.4	.4	.4	.4
Textiles and apparel	22,23	(1)	.3	.5	.5	.5	.5	.4	.4	.4	4	.4	.4	.4	.4	.4	.4
Lumber, wood products, and furniture	24,25	(1)	.4	.5	.3	.8	.7	.8	.7	.8	[illegible]	.7	.9	.7	.7	.9	.9
Paper and allied products	26	.6	.7	.8	.9	.9	.9	.8	.7	.8	9	1.0	.9	.9	1.0	1.0	(1)
Chemicals and allied products	28	3.5	3.8	4.3	4.6	3.9	3.7	3.6	3.5	3.5	.7	3.7	3.6	3.6	3.5	3.6	3.8
Industrial chemicals	281-82,286	5.0	5.4	5.1	4.8	4.2	3.9	3.9	3.6	3.3	3.6	3.7	3.5	3.5	3.2	3.3	3.5
Drugs and medicines	283	3.6	4.1	4.7	6.1	6.7	6.2	6.5	6.5	6.3	6.4	6.3	6.4	6.2	6.1	6.2	(1)
Other chemicals	284-85,287-89	1.3	1.5	2.8	2.3	1.8	1.9	1.7	1.6	1.6	1.7	1.7	1.8	1.8	1.8	1.9	(1)
Petroleum refining and related industries	29	.7	1.1	1.0	.8	1.0	.9	.8	.7	.6	.7	.6	.7	.7	.7	.6	(1)
Rubber products	30	1.7	1.8	2.3	1.9	2.3	2.2	2.6	2.6	2.5	2.5	2.4	2.1	1.9	1.9	2.2	(1)
Stone, clay, and glass products	32	(2)	(2)	1.6	1.8	1.8	1.8	1.7	1.7	1.7	1.2	1.2	1.3	1.3	1.3	1.4	(1)
Primary metals	33	.5	.7	.8	.8	.8	.8	.7	.7	.6	.8	.8	.7	.7	.6	.7	.8
Ferrous metals and products[3]	331-32,3398-99	(1)	.6	.7	.8	.7	.7	.6	.5	.5	.6	.6	.6	.6	.6	.7	(1)
Nonferrous metals and products[3]	333-36	(1)	.7	1.1	1.0	1.0	1.0	.9	.9	1.0	1.2	1.2	1.0	.8	.7	.7	(1)
Fabricated metal products	34	1.6	1.7	1.6	1.3	1.2	1.2	1.1	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.4	1.4
Machinery	35	3.4	3.8	4.2	4.2	4.0	4.0	4.3	4.6	4.6	4.8	4.9	4.9	4.6	4.5	5.0	5.2
Office, computing, and accounting machines	357	(4)	(4)	(4)	(4)	(4)	(4)	11.1	11.6	12.6	12.0	11.6	11.5	11.1	11.0	12.0	(1)
Other machinery, except electrical	351-56,358-59	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	2.2	2.1	2.1	2.3	(1)
Electrical equipment	36	7.6	10.3	10.1	8.6	7.3	7.2	7.1	6.9	6.6	6.5	6.7	6.9	5.8	6.0	6.6	6.8
Radio and TV receiving equipment	365	(6)	(6)	(6)	1.9	2.7	2.4	1.6	1.7	1.7	1.4	1.4	1.8	1.9	2.5	4.3	(1)
Communication equipment	366	(1)	11.3	13.0	10.3	8.2	8.2	8.7	8.1	7.6	7.6	7.6	7.7	7.7	8.8	9.1	9.6
Electronic components	367							5.9	6.2	6.2	6.9	7.3	6.8	6.7	7.1	7.9	7.4
Other electrical equipment	361-64,369	(1)	9.7	7.3	7.3	6.6	6.4	6.3	6.3	6.3	6.0	6.3	5.2	5.1	4.9	4.9	(1)
Motor vehicles and motor vehicles equipment	371	2.9	4.2	3.4	3.4	3.5	3.1	3.3	3.5	3.7	3.5	3.2	3.1	3.3	3.9	4.9	4.5
Other transportation equipment	373-75,379							1.0	1.2	1.3	1.3	1.3	1.2	.8	.8	.6	(1)
Aircraft and missiles	372,376	16.8	17.7	26.7	19.7	16.2	16.2	16.6	13.3	14.1	12.7	12.7	13.3	13.3	12.9	13.7	15.3
Professional and scientific instruments	38	7.0	7.8	5.9	5.4	5.7	5.7	5.9	6.1	6.1	5.9	6.2	6.3	6.9	7.3	7.5	8.2
Scientific and mechanical measuring instruments	381-82	9.5	10.2	4.1	3.9	3.5	3.7	4.1	4.3	4.5	4.9	5.4	6.3	7.1	7.3	8.4	(1)
Optical, surgical, photographic, and other instruments	383-87	5.2	6.3	6.9	6.0	6.6	6.4	6.6	6.8	6.7	6.3	6.4	6.4	6.8	7.2	6.9	(1)
Other manufacturing industries	21,27,31,39	(1)	1.3	.7	.6	.8	.8	.8	.8	.9	.8	.7	.6	.5	.4	.4	.4
Distribution by size of company (based on number of employees)																	
Less than 1,000	....	1.8	1.3	1.9	1.7	1.9	1.7	1.7	1.6	1.8	1.6	1.7	1.5	1.6	1.6	1.4	1.8
1,000 to 4,999	....	[7]1.8	1.8	2.4	1.7	1.7	1.6	1.7	1.6	1.5	1.4	1.4	1.6	1.6	1.9	1.8	1.9
5,000 to 9,999	....	[7]3.9	4.8	5.3	2.1	2.3	2.2	1.9	1.8	1.8	1.8	1.9	2.0	1.4	1.3	1.4	1.7
10,000 to 24,999	....				5.2	4.4	4.2	1.9	1.7	1.6	1.7	1.8	1.9	1.9	1.7	1.7	1.8
25,000 or more	....							4.7	4.5	4.2	4.5	4.2	4.2	4.0	3.8	4.0	4.0

[1] Not separately available but included in total. See general notes.

[2] Included in the other manufacturing industries group.

[3] SIC codes 3398 and 3399 included in the nonferrous metals and products group for 1957-63.

[4] Data not tabulated at this level prior to 1972.

[5] Data not tabulated at this level prior to 1977.

[6] Included in the other electrical equipment group.

[7] Separate data for companies with 5,000 or more employees and for companies with 1,000 to 4,999 employees were estimated by the National Science Foundation for 1957. Revisions of statistics by the U.S. Bureau of the Census for this year did not yield separate data for companies in these size groups.

SOURCE: National Science Foundation.

Table B-22. Company R&D funds as a percent of net sales in R&D-performing manufacturing companies by industry and size of company: 1957-58, 1963, 1967, and 1970-81

Industry and size of company	SIC code	1957	1958	1963	1967	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
Total		1.5	1.6	1.9	2.1	2.2	2.1	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.9	2.1	2.2
Distribution by industry																	
Food and kindred products	20	.3	.3	(1)	.5	.5	.5	.4	.4	.4	(1)	(1)	(1)	(1)	(1)	(1)	.4
Textiles and apparel	22,23	(1)	.2	.4	(1)	(1)	.5	.4	.4	(1)	(1)	(1)	(1)	(1)	(1)	(1)	.4
Lumber, wood products, and furniture	24,25	(1)	.4	(1)	.3	.8	(1)	(1)	(1)	(1)	.7	.7	.8	.7	.7	.9	.9
Paper and allied products	26	.6	.7	.8	(1)	(1)	(1)	.8	(1)	(1)	(1)	(1)	(1)	(1)	(1)	1.0	1.0
Chemicals and allied products	28	3.1	3.2	3.6	4.0	3.5	3.3	3.3	3.1	3.0	3.1	3.3	3.3	3.2	3.2	3.3	3.5
Industrial chemicals	281-82,286	4.2	4.3	4.1	3.9	3.6	3.3	3.2	3.0	2.8	3.1	3.1	3.0	2.9	2.6	2.9	3.0
Drugs and medicines	283	3.6	4.0	4.5	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	6.1	6.3
Other chemicals	284-85,287-89	1.2	1.3	1.8	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	1.9	2.1
Petroleum refining and related industries	29	.7	1.1	1.2	.8	.9	.8	.7	.7	.5	(1)	.6	.6	.7	.6	.5	.6
Rubber products	30	1.1	1.4	1.6	1.7	1.7	1.7	1.7	1.7	(1)	(1)	(1)	(1)	(1)	(1)	(1)	1.9
Stone, clay, and glass products	32	(2)	(2)	1.6	1.7	1.7	1.6	1.6	1.5	1.5	(1)	(1)	(1)	(1)	(1)	1.3	1.4
Primary metals	33	.5	.6	.7	.8	.8	.8	.7	.6	.5	.7	.8	.7	.6	.5	.5	.6
Ferrous metals and products[3]	331-32,3398-99	(1)	.6	.7	.7	.7	.7	.6	.5	(1)	.6	.6	.6	.5	.5	.5	.6
Nonferrous metals and products[3]	333-36	(1)	.6	.9	.9	.9	1.0	.9	.8	(1)	1.1	1.1	.9	.8	.6	.6	.7
Fabricated metal products	34	1.1	1.1	1.4	1.2	1.1	1.1	1.1	1.2	1.1	1.1	1.1	1.1	1.0	1.0	1.2	1.3
Machinery	35	2.0	2.1	3.1	3.2	3.4	3.3	3.5	3.8	3.8	4.0	4.2	4.3	4.2	4.2	4.5	4.6
Office, computing, and accounting machines	357	(4)	(4)	(4)	(4)	(4)	(4)	(1)	(1)	(1)	9.4	9.1	9.6	9.8	10.1	10.4	10.1
Other machinery, except electrical	351-56,358-59	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	2.1	2.0	2.0	2.2	2.3
Electrical equipment	36	2.6	3.3	3.6	3.5	3.4	3.5	3.5	3.5	3.5	3.6	3.7	3.4	3.4	3.6	3.9	4.2
Radio and TV receiving equipment	365	(6)	(6)	(6)	(1)	(1)	(1)	(1)	(1)	(1)	1.4	1.4	1.6	1.4	1.7	2.7	2.7
Communication equipment	366	(1)	3.3	4.2	3.9	3.7	3.8	3.9	3.9	3.9	4.2	4.3	4.4	4.5	5.0	5.4	6.0
Electronic components	367							3.7	3.9	3.9	(1)	(1)	(1)	(1)	(1)	5.9	5.7
Other electrical equipment	361-64,369	(1)	3.3	3.0	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	2.5	2.8
Motor vehicles and motor vehicles equipment	371	2.1	2.8	2.5	2.5	2.8	2.5	2.8	2.9	3.2	3.0	2.7	2.7	2.9	3.2	4.2	3.9
Other transportation equipment	373-75,379							.6	.6	.6	.6	.6	.7	(1)	(1)	.3	(1)
Aircraft and missiles	372,376	2.0	2.3	2.6	4.0	3.8	3.4	3.3	3.0	3.5	2.8	2.8	2.9	3.2	3.5	3.8	4.2
Professional and scientific instruments	38	3.9	4.1	4.2	3.5	4.2	4.5	4.8	5.1	5.2	5.1	5.4	5.4	5.7	5.8	6.1	6.8
Scientific and mechanical measuring instruments	381-82	4.0	4.0	3.1	2.5	2.9	3.3	3.8	4.0	4.4	4.7	5.3	5.7	5.9	5.8	6.2	7.0
Optical, surgical, photographic, and other instruments	383-87	3.8	4.1	4.8	3.9	4.7	4.9	5.1	5.5	5.5	5.2	5.5	5.4	5.6	5.9	6.0	6.7
Other manufacturing industries	21,27,31,39	(1)	(1)	.6	(1)	.8	(1)	(1)	(1)	(1)	.7	.7	.6	.5	.4	.4	.4
Distribution by size of company (based on number of employees)																	
Less than 1,000		1.4	.7	1.5	1.6	1.6	1.5	1.5	1.5	1.6	1.4	1.5	1.5	1.4	1.5	1.2	1.4
1,000 to 4,999		[7]1.2	1.3	1.5	1.4	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.4	1.4	1.4	1.4	1.5
5,000 to 9,999		[7]1.6	1.9	2.1	1.6	1.8	1.8	1.5	1.5	1.4	1.5	1.6	1.5	1.2	1.1	1.1	1.1
10,000 to 24,999					2.3	2.4	2.3	1.4	1.3	1.3	1.5	1.4	1.4	1.4	1.4	1.4	1.5
25,000 or more								2.5	2.5	2.4	2.6	2.5	2.4	2.5	2.4	2.5	2.9

[1] Not separately available but included in total. See general notes.
[2] Data included in the other manufacturing industries group.
[3] SIC codes 3398 and 3399 included in the nonferrous metals and products group for 1957-63.
[4] Data not tabulated at this level prior to 1972.
[5] Data not tabulated at this level prior to 1977.
[6] Included in the other electrical equipment group.
[7] Estimated by the National Science Foundation.

SOURCE: National Science Foundation.

Table B-23. R&D funds as a percent of net sales in R&D-performing manufacturing companies ranked by size of R&D program by industry: 1981

Industry	SIC code	First 4 companies	Next 4 companies	Next 12 companies
Total		11.0	10.0	7.2
Food and kindred products	20	1.6	.9	.5
Textiles and apparel	22,23	.8	.6	.4
Lumber, wood products, and furniture	24,25	1.8	.9	.7
Paper and allied products	26	3.0	1.0	.5
Chemicals and allied products	28	5.0	5.1	6.3
Industrial chemicals	281-82,286	5.0	4.0	2.1
Drugs and medicines	283	10.3	6.7	4.9
Other chemicals	284-85,287-89	3.0	1.8	1.7
Petroleum refining and related industries	29	.9	.6	.3
Rubber products	30	3.7	2.5	2.2
Stone, clay, and glass products	32	4.3	1.2	.8
Primary metals	33	1.2	.9	.8
Ferrous metals and products	331-32,3398-99	1.0	.9	.6
Nonferrous metals and products	333-36	1.7	1.0	1.0
Fabricated metal products	34	2.4	1.6	2.0
Machinery	35	12.4	5.9	5.5
Office, computing, and accounting machines	357	14.6	8.5	6.3
Other machinery, except electrical	351-56,358-59	4.7	3.7	2.2
Electrical equipment	36	11.3	6.0	8.0
Radio and TV receiving equipment	365	4.6	7.9	2.0
Communication equipment	366	10.5	9.9	6.3
Electronic components	367	8.9	10.9	6.6
Other electrical equipment	361-64,369	8.3	2.6	2.2
Motor vehicles and motor vehicles equipment	371	5.0	4.2	1.3
Other transportation equipment	373-75,379	3.2	1.5	1.5
Aircraft and missiles	372,376	25.7	13.4	7.3
Professional and scientific instruments	38	10.4	11.0	6.4
Scientific and mechanical measuring instruments	381-82	12.3	5.9	7.6
Optical, surgical, photographic, and other instruments	383-87	9.1	7.4	4.2
Other manufacturing industries	21,27,31,39	.7	2.3	.8

SOURCE: National Science Foundation.

Table B-24. Company R&D funds as a percent of net sales in R&D-performing manufacturing companies ranked by size of net sales by industry: 1981

[Dollars in millions]

Industry	SIC code	Company R&D funds		Net sales		Company R&D funds as a percent of net sales	
		First 8 companies	Next 12 companies	First 8 companies	Next 12 companies	First 8 companies	Next 12 companies
Total		$4,573	$5,902	$254,681	$194,503	1.8	3.0
Food and kindred products	20	194	125	59,417	43,708	.3	.3
Textiles and apparel	22,23	40	33	12,060	6,925	.3	.5
Lumber, wood products, and furniture	24,25	105	34	10,839	3,783	1.0	.9
Paper and allied products	26	347	132	28,354	13,770	1.2	1.0
Chemicals and allied products	28	1,553	1,020	51,845	28,907	3.0	3.5
Industrial chemicals	281-82,286	1,400	611	46,707	19,335	3.0	3.2
Drugs and medicines	283	926	850	16,951	10,987	5.5	7.7
Other chemicals	284-85,287-89	403	153	18,626	7,274	2.2	2.1
Petroleum refining and related industries	29	1,458	274	210,261	75,213	.7	.4
Rubber products	30	419	91	20,383	4,670	2.1	1.9
Stone, clay, and glass products	32	311	56	14,994	8,087	2.1	.7
Primary metals	33	304	185	59,788	29,687	.5	.6
Ferrous metals and products	331-32,3398-99	252	100	47,954	13,692	.5	.7
Nonferrous metals and products	333-36	186	70	33,431	6,779	.6	1.0
Fabricated metal products	34	267	87	19,035	8,075	1.4	1.1
Machinery	35	3,169	1,087	42,100	21,276	7.5	5.1
Office, computing, and accounting machines	357	3,184	459	30,542	4,542	10.4	10.1
Other machinery, except electrical	351-56,358-59	929	268	26,512	15,034	3.5	1.8
Electrical equipment	36	3,955	814	77,129	30,220	5.1	2.7
Radio and TV receiving equipment	365	328	14	12,773	613	2.6	2.3
Communication equipment	366	2,687	154	42,936	3,770	6.3	4.1
Electronic components	367	796	297	13,755	4,093	5.8	7.3
Other electrical equipment	361-64,369	1,380	252	45,346	9,817	3.0	2.6
Motor vehicles and motor vehicles equipment	371	4,176	88	98,713	8,340	4.2	1.0
Other transportation equipment	373-75,379	70	11	28,410	2,002	.2	.6
Aircraft and missiles	372,376	2,430	689	53,049	20,420	4.6	3.4
Professional and scientific instruments	38	2,067	365	26,907	6,729	7.7	5.4
Scientific and mechanical measuring instruments	381-82	884	103	11,865	2,293	7.5	4.5
Optical, surgical, photographic, and other instruments	383-87	1,506	81	19,994	3,169	7.5	2.6
Other manufacturing industries	21,27,31,39	140	111	33,153	11,966	.4	.9

SOURCE: National Science Foundation.

Table B-25. Percent of net sales and employment of R&D-performing companies ranked by size of R&D program: 1972-81

Companies ranked by size of R&D program (based on total R&D funds)[1]	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
	Percent of net sales									
First 4 (1-4)	10	9	6	6	9	9	9	9	5	5
Next 4 (5-8)	3	3	5	5	3	3	3	3	4	4
Next 12 (9-20)	6	6	5	6	6	6	6	5	8	8
Next 20 (21-40)	7	7	11	10	10	10	10	11	7	7
Next 60 (41-100)	16	17	16	16	16	14	14	14	17	18
Next 100 (101-200)	14	14	14	12	11	14	14	14	12	12
Next 200 (201-400)	15	16	17	15	16	16	17	17	14	13
	Percent of employment									
First 4 (1-4)	9	8	7	7	8	8	8	9	7	7
Next 4 (5-8)	4	4	5	5	4	4	4	4	4	4
Next 12 (9-20)	7	7	6	6	7	7	7	7	7	6
Next 20 (21-40)	8	8	9	8	9	8	8	8	8	8
Next 60 (41-100)	12	12	13	13	13	13	12	12	13	13
Next 100 (101-200)	12	12	11	11	11	13	13	13	13	12
Next 200 (201-400)	16	16	16	15	16	15	15	16	14	14

[1] Companies were ranked individually for each year; therefore, particular companies comprising the size groups may have changed from year to year.

SOURCE: National Science Foundation.

Table B-26. Percent of total and Federal R&D funds and of net sales of R&D-performing companies ranked by size of R&D program by industry: 1981

Industry	SIC code	Percent of total R&D funds			Percent of Federal R&D funds			Percent of net sales of all R&D performing companies		
		First 4 companies	Next 4	Next 12	First 4 companies	Next 4	Next 12	First 4 companies	Next 4	Next 12
Total	....	19	12	19	20	18	32	5	4	8
Food and kindred products	20	33	14	23	0	0	2	8	7	18
Textiles and apparel	22,23	35	14	18	0	0	0	18	10	20
Lumber, wood products, and furniture	24,25	66	11	10	8	0	0	32	11	13
Paper and allied products	26	66	11	16	40	0	60	23	12	32
Chemicals and allied products	28	30	14	24	91	(1)	3	22	10	14
Industrial chemicals	281-82,286	62	15	18	94	2	2	43	13	30
Drugs and medicines	283	34	22	36	0	57	31	21	21	46
Other chemicals	284-85,287-89	49	10	18	83	0	3	34	11	22
Petroleum refining and related industries	29	59	27	14	95	2	3	42	29	27
Rubber products	30	64	14	10	94	1	4	43	14	12
Stone, clay, and glass products	32	64	18	11	98	2	0	24	25	23
Primary metals	33	43	15	23	78	8	10	27	12	22
Ferrous metals and products	331-32,3398-99	59	15	18	96	2	2	45	14	24
Nonferrous metals and products	333-36	55	19	20	40	44	16	26	14	16
Fabricated metal products	34	42	16	16	72	(1)	23	25	14	11
Machinery	35	51	9	16	78	(1)	13	21	8	15
Office, computing, and accounting machines	357	74	11	9	97	(1)	2	59	15	16
Other machinery, except electrical	351-56,358-59	35	13	12	67	2	2	18	9	14
Electrical equipment	36	54	15	15	61	17	15	32	17	12
Radio and TV receiving equipment	365	92	3	3	99	1	0	88	2	7
Communication equipment	366	78	13	6	67	24	7	72	13	10
Electronic components	367	55	16	18	84	4	7	45	11	20
Other electrical equipment	361-64,369	84	4	6	98	(1)	2	51	7	14
Motor vehicles and motor vehicles equipment	371	90	7	3	76	20	4	80	7	9
Other transportation equipment	373-75,379	81	10	7	96	3	(1)	13	4	81
Aircraft and missiles	372,376	56	30	13	59	28	12	33	34	27
Professional and scientific instruments	38	56	15	13	62	24	10	44	11	16
Scientific and mechanical measuring instruments	381-82	68	8	9	89	6	2	50	13	10
Optical, surgical, photographic, and other instruments	383-87	77	11	5	96	0	3	64	11	10
Other manufacturing industries	21,27,31,39	40	18	17	37	0	0	23	3	9
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	42	26	18	57	34	6	5	1	6

Note: All rankings are based on total R&D funds.

[1] Less than .5 percent.

SOURCE: National Science Foundation.

Table B-27. Funds for basic research, applied research, and development performance: 1953-81

[Dollars in millions]

Year	Total	Basic research	Applied research	Development
1953	$3,630	$151	[1]$726	[1]$2,753
1954	4,070	166	[1]814	[1]3,090
1955	4,640	189	[1]928	[1]3,523
1956	6,605	253	1,268	5,084
1957	7,731	271	1,670	5,790
1958	8,389	295	1,911	6,183
1959	9,618	320	1,991	7,307
1960	10,509	376	2,029	8,104
1961	10,908	395	1,977	8,537
1962	11,464	488	2,449	8,527
1963	12,630	522	2,457	9,651
1964	13,512	549	2,600	10,362
1965	14,185	592	2,658	10,934
1966	15,548	624	2,843	12,081
1967	16,385	629	2,915	12,842
1968	17,429	642	3,124	13,663
1969	18,308	618	3,287	14,403
1970	18,067	602	3,427	14,038
1971	18,320	590	3,415	14,315
1972	19,552	593	3,514	15,445
1973	21,249	631	3,825	16,793
1974	22,887	699	4,288	17,900
1975	24,187	730	4,570	18,887
1976	26,997	819	5,112	21,066
1977	29,825	911	5,636	23,278
1978	33,304	[2]1,035	[2]6,300	[2]25,969
1979	38,226	1,158	7,225	29,843
1980	44,505	[2]1,325	[2]8,450	[2]34,730
1981	51,830	1,641	10,712	39,477

[1] Estimated by the National Science Foundation.

[2] National Science Foundation, National Patterns of Science and Technology Resources, 1983 (in press) (Washington, D.C.: Supt. of Documents, U.S. Government Printing Office, 1983).

SOURCE: National Science Foundation.

Table B-28. Funds for basic research, applied research, and development by industry and size of company: 1981

[Dollars in millions]

Industry and size of company	SIC code	Total	Basic research	Applied research	Development
Total		$51,830	$1,641	$10,712	$39,477
Distribution by industry					
Food and kindred products	20	719	27	(1)	(1)
Textiles and apparel	22,23	124	1	31	92
Lumber, wood products, and furniture	24,25	167	(1)	(1)	95
Paper and allied products	26	(1)	32	(1)	370
Chemicals and allied products	28	5,325	539	2,263	2,523
Industrial chemicals	281-82,286	2,553	335	(1)	1,105
Drugs and medicines	283	(1)	(1)	(1)	(1)
Other chemicals	284-85,287-89	(1)	24	(1)	456
Petroleum refining and related industries	29	(1)	(1)	(1)	989
Rubber products	30	(1)	23	(1)	(1)
Stone, clay, and glass products	32	(1)	(1)	(1)	307
Primary metals	33	889	46	341	502
Ferrous metals and products	331-32,3398-99	(1)	(1)	(1)	(1)
Nonferrous metals and products	333-36	(1)	16	(1)	(1)
Fabricated metal products	34	638	8	153	477
Machinery	35	6,800	128	1,252	5,420
Office, computing, and accounting machines	357	(1)	(1)	(1)	3,611
Other machinery, except electrical	351-56,358-59	(1)	(1)	(1)	1,809
Electrical equipment	36	10,466	279	1,782	8,405
Radio and TV receiving equipment	365	(1)	(1)	132	(1)
Communication equipment	366	4,737	(1)	(1)	3,774
Electronic components	367	1,659	(1)	285	(1)
Other electrical equipment	361-64,369	(1)	(1)	(1)	2,803
Motor vehicles and motor vehicles equipment	371	4,929	(1)	(1)	(1)
Other transportation equipment	373-75,379	(1)	(1)	(1)	77
Aircraft and missiles	372,376	11,702	128	1,451	10,123
Professional and scientific instruments	38	3,685	(1)	(1)	(1)
Scientific and mechanical measuring instruments	381-82	(1)	(1)	248	(1)
Optical, surgical, photographic, and other instruments	383-87	(1)	(1)	(1)	(1)
Other manufacturing industries	21,27,31,39	393	21	(1)	(1)
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	(1)	(1)	865	(1)
Distribution by size of company (based on number of employees)					
Less than 1,000		2,522	153	715	1,654
1,000 to 4,999		3,213	179	1,066	1,968
5,000 to 9,999		2,425	118	607	1,700
10,000 to 24,999		6,938	229	2,125	4,584
25,000 or more		36,732	962	6,199	29,571

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-29. Funds for basic research, applied research, and development by industry, source of funds, and selected company size-groups: 1981

[Dollars in millions]

Industry and size of company	SIC code	Federal				Company			
		Total	Basic research	Applied research	Development	Total	Basic research	Applied research	Development
Total		$16,468	$328	$2,353	$13,787	$35,362	$1,313	$8,359	$25,690
Distribution by industry									
Food and kindred products	20	6	0	(1)	(1)	713	27	287	399
Textiles and apparel	22,23	1	0	1	0	123	1	30	92
Lumber, wood products, and furniture	24,25	0	0	0	0	167	(1)	(1)	95
Paper and allied products	26	(1)	0	(1)	0	562	32	160	370
Chemicals and allied products	28	383	81	134	168	4,942	458	2,129	2,355
Industrial chemicals	281-82,286	367	(1)	(1)	163	2,186	254	990	942
Drugs and medicines	283	(1)	(1)	(1)	5	1,997	(1)	(1)	(1)
Other chemicals	284-85,287-89	(1)	0	(1)	0	759	24	279	456
Petroleum refining and related industries	29	(1)	(1)	(1)	(1)	1,777	133	751	892
Rubber products	30	(1)	(1)	(1)	(1)	616	(1)	(1)	(1)
Stone, clay, and glass products	32	(1)	(1)	(1)	(1)	411	16	125	270
Primary metals	33	182	0	10	172	707	46	331	330
Ferrous metals and products	331-32,3398-99	(1)	0	(1)	(1)	414	(1)	(1)	203
Nonferrous metals and products	333-36	(1)	0	(1)	(1)	293	16	151	126
Fabricated metal products	34	80	0	12	68	558	8	141	409
Machinery	35	739	2	224	513	6,061	126	1,028	4,907
Office, computing, and accounting machines	357	(1)	(1)	(1)	(1)	3,919	(1)	(1)	3,228
Other machinery, except electrical	351-56,358-59	(1)	(1)	(1)	(1)	2,142	(1)	(1)	1,679
Electrical equipment	36	3,962	47	446	3,470	6,502	232	1,336	4,935
Radio and TV receiving equipment	365	(1)	0	(1)	(1)	364	(1)	(1)	(1)
Communication equipment	366	1,791	(1)	(1)	1,597	2,946	(1)	(1)	(1)
Electronic components	367	376	(1)	17	(1)	1,282	(1)	268	(1)
Other electrical equipment	361-64,369	(1)	(1)	(1)	(1)	1,910	(1)	(1)	1,499
Motor vehicles and motor vehicles equipment	371	634	(1)	(1)	(1)	4,295	21	(1)	(1)
Other transportation equipment	373-75,379	(1)	(1)	(1)	(1)	86	(1)	(1)	48
Aircraft and missiles	372,376	8,501	59	877	7,566	3,201	69	574	2,557
Professional and scientific instruments	38	638	(1)	(1)	(1)	3,047	(1)	(1)	(1)
Scientific and mechanical measuring instruments	381-82	(1)	(1)	(1)	(1)	1,285	(1)	210	(1)
Optical, surgical, photographic, and other instruments	383-87	(1)	(1)	(1)	(1)	1,762	(1)	(1)	(1)
Other manufacturing industries	21,27,31,39	0	0	(1)	0	393	21	(1)	(1)
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	(1)	(1)	523	(1)	1,199	(1)	342	(1)
Distribution by size of company (based on number of employees)									
5,000 to 9,999		559	1	97	461	1,866	117	510	1,239
10,000 to 24,999		1,253	58	246	949	5,685	171	1,879	3,635
25,000 or more		13,661	225	1,653	11,783	23,071	737	4,546	17,788

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-30. Funds for basic research by industry and size of company: 1957-58, 1963, 1967, 1970-77, 1979, and 1981

[Dollars in millions]

Industry and size of company	SIC code	[1]1957	[1]1958	1963	1967	1970	1971	1972	1973	1974	1975	1976	1977	1979	1981
Total	....	$271	$295	$522	$629	$602	$590	$593	$631	$699	$730	$819	$911	$1,158	$1,641
Distribution by industry															
Food and kindred products	20	4	5	12	17	16	15	13	11	9	10	18	20	17	27
Textiles and apparel	22,23	1	1	1	2	2	2	2	1	2	(2)	(2)	(2)	(2)	1
Lumber, wood products, and furniture	24,25	0	0	0	0	(2)	(2)	(2)	(2)	(2)	3	5	7	5	(2)
Paper and allied products	26	1	(2)	2	4	5	4	4	5	7	5	6	9	18	32
Chemicals and applied products	28	82	92	152	184	207	216	214	236	288	294	304	337	366	539
Industrial chemicals	281-82,286	(2)	(2)	105	(2)	(2)	118	117	125	157	154	154	163	197	335
Drugs and medicines	283	18	21	33	45	93	77	78	90	107	112	119	134	143	(2)
Other chemicals	284-85,287-89	6	6	14	14	18	21	19	21	24	27	32	40	(2)	24
Petroleum refining and related industries	29	35	34	34	36	26	21	22	26	33	36	44	48	74	(2)
Rubber products	30	4	(2)	8	5	5	4	6	3	5	4	7	9	18	23
Stone, clay, and glass products	32	(3)	(3)	6	(2)	(2)	14	18	20	21	32	38	41	40	(2)
Primary metals	33	6	7	11	13	18	17	9	8	9	14	16	14	24	46
Ferrous metals and products[4]	331-32,3398-99	5	5	8	(2)	(2)	(2)	(2)	(2)	(2)	4	5	5	12	(2)
Nonferrous metals and products[4]	333-36	(2)	2	3	4	8	(2)	(2)	(2)	(2)	10	12	9	12	16
Fabricated metal products	34	1	1	5	3	5	(2)	7	11	3	5	2	2	4	8
Machinery	35	17	20	25	26	21	22	24	24	28	32	56	57	66	128
Office, computing, and accounting machines	357	(5)	(5)	(5)	(5)	(5)	(5)	(2)	(2)	(2)	26	38	41	51	(2)
Other machinery, except electrical	351-56,358-59	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	18	16	15	(2)
Electrical equipment	36	53	63	133	131	139	138	137	143	143	132	163	181	228	279
Radio and TV receiving equipment	365	(7)	(7)	(7)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Communication equipment	366	36	43	110	112	122	120	108	117	116	109	130	150	195	(2)
Electronic components	367							10	8	5	4	5	6	7	(2)
Other electrical equipment	361-64,369	17	21	23	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Motor vehicles and motor vehicles equipment	371	5	(2)	28	(2)	(2)	21	10	8	9	10	8	12	(2)	(2)
Other transportation equipment	373-75,379							(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Aircraft and missiles	372,376	25	26	59	73	63	50	62	58	57	54	54	55	88	128
Professional and scientific instruments	38	8	10	(2)	(2)	(2)	19	17	15	16	16	23	24	(2)	40
Scientific and mechanical measuring instruments	381-82	3	2	1	(2)	(2)	7	6	5	5	9	10	12	(2)	(2)
Optical, surgical, photographic, and other instruments	383-87	6	8	(2)	(2)	(2)	12	11	10	11	8	12	12	(2)	(2)
Other manufacturing industries	21,27,31,39	13	8	3	5	4	6	5	6	6	(2)	(2)	(2)	42	21
Nonmanufacturing industries	07-17,41-67, 737,739,807,891	(2)	(2)	28	52	38	31	28	28	26	25	29	44	57	(2)
Distribution by size of company (based on number of employees)															
Less than 1,000	....	(2)	(2)	(2)	56	38	36	36	32	34	57	68	75	98	153
1,000 to 4,999	....	24	32	31	45	58	51	45	58	47	34	52	54	69	179
5,000 to 9,999	....	218	240	439	50	62	72	58	75	88	103	118	125	158	118
10,000 to 24,999	....				478	444	431	90	98	102	96	138	168	211	229
25,000 or more	....							364	368	428	440	443	489	622	952

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[1] Estimated by the National Science Foundation.

[2] Not separately available but included in total. See general notes.

[3] Data included in the other manufacturing industries group.

[4] SIC codes 3398 and 3399 included in the nonferrous metals and products group for 1957-65.

[5] Data not tabulated at this level prior to 1972.

[6] Data not tabulated at this level prior to 1975.

[7] Included in the other electrical equipment group.

SOURCE: National Science Foundation.

Table B-31. Funds for basic research by field of science and engineering: 1967, 1970-77, 1979, and 1981

[Dollars in millions]

Field of science and engineering	1967	1970	1971	1972	1973	1974	1975	1976	1977	1979	1981
Total	$629	$602	$590	$593	$631	$699	$729	$817	$911	$1,158	$1,641
Physical sciences	308	297	281	277	276	319	320	359	405	527	650
Chemistry	162	196	180	183	193	229	228	253	285	381	485
Physics	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Astronomy	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Mathematics	12	13	14	12	14	13	14	18	19	20	26
Environmental sciences	14	8	8	6	7	10	15	17	19	13	24
Atmospheric sciences	(1)	(1)	3	(1)	2	3	6	6	5	5	14
Geological sciences	(1)	(1)	3	4	3	5	5	7	7	6	8
Oceanography	(1)	(1)	2	(1)	1	1	3	4	7	2	(1)
Engineering (including metallurgy)	172	170	159	183	185	178	191	204	233	292	402
Life sciences	69	86	94	82	102	119	122	134	156	177	254
Biological sciences	(1)	51	57	61	77	83	85	102	128	136	157
Clinical medical sciences	(1)	35	37	21	25	36	37	32	28	40	97
Other sciences	53	28	34	33	47	60	67	85	78	128	285

Note: Data not collected for 1978 and 1980.

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-32. Funds for basic research by industry and field of science and engineering: 1981

[Dollars in millions]

Industry	SIC code	Total	Physical sciences	Mathematics	Environmental sciences	Engineering (including metallurgy)	Life sciences	Other sciences
Total	....	$1,641	$650	$26	$24	$402	$254	$285
Food and kindred products	20	27	6	0	0	3	14	4
Textiles and apparel	22,23	1	0	0	0	1	0	0
Lumber, wood products, and furniture	24,25	(1)	(1)	0	0	0	(1)	1
Paper and allied products	26	32	19	0	0	(1)	(1)	2
Chemicals and allied products	28	539	306	(1)	(1)	19	196	14
Industrial chemicals	281-82,286	335	185	(1)	(1)	16	121	9
Drugs and medicines	283	(1)	(1)	0	0	(1)	71	(1)
Other chemicals	284-85,287-89	24	19	0	0	(1)	4	(1)
Petroleum refining and related industries	29	(1)	(1)	(1)	(1)	(1)	2	(1)
Rubber products	30	23	(1)	0	0	(1)	(1)	1
Stone, clay, and glass products	32	(1)	25	0	10	(1)	(1)	2
Primary metals	33	46	(1)	0	0	26	(1)	(1)
Ferrous metals and products	331-32,3398-99	(1)	(1)	0	0	17	(1)	(1)
Nonferrous metals and products	333-36	16	(1)	0	0	9	(1)	0
Fabricated metal products	34	8	(1)	0	0	(1)	0	0
Machinery	35	128	(1)	12	0	23	0	30
Office, computing, and accounting machines	357	(1)	(1)	12	0	(1)	0	30
Other machinery, except electrical	351-56,358-59	(1)	(1)	0	0	19	0	0
Electrical equipment	36	279	72	11	0	130	(1)	(1)
Radio and TV receiving equipment	365	(1)	(1)	0	0	2	(1)	(1)
Communication equipment	366	(1)	58	11	0	(1)	0	(1)
Electronic components	367	(1)	3	0	0	(1)	0	(1)
Other electrical equipment	361-64,369	(1)	(1)	0	0	31	(1)	0
Motor vehicles and motor vehicles equipment	371	(1)	7	0	(1)	7	0	(1)
Other transportation equipment	373-75,379	(1)	(1)	0	0	4	(1)	0
Aircraft and missiles	372,376	128	10	(1)	(1)	105	5	(1)
Professional and scientific instruments	38	(1)	(1)	0	1	(1)	(1)	(1)
Scientific and mechanical measuring instruments	381-82	(1)	0	0	1	(1)	0	(1)
Optical, surgical, photographic, and other instruments	383-87	(1)	(1)	0	0	(1)	(1)	0
Other manufacturing industries	21,27,31,39	21	(1)	0	0	4	0	(1)
Nonmanufacturing industries	07-17,41-67, 737,739,807,891	(1)	(1)	0	(1)	(1)	(1)	21

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-33. Number of R&D-performing companies conducting basic research by industry: 1981

Industry	SIC code	Companies with total employment of--									
		Less than 1,000		1,000 to 4,999		5,000 to 9,999		10,000 to 24,999		25,000 or more	
		R&D	Basic research	R&D	Basic research	R&D	Basic research	R&D	Basic research	R&D	Basic research
Total	....	1,710	25	839	68	218	39	211	63	141	60
Food and kindred products	20	74	0	56	5	22	5	25	4	10	3
Textiles and apparel	22,23	46	0	46	2	14	1	12	1	4	0
Lumber, wood products, and furniture	24,25	36	0	36	1	9	0	3	1	2	0
Paper and allied products	26	21	1	33	4	6	1	10	3	6	3
Chemicals and allied products	28	187	9	62	15	15	7	24	14	11	8
Industrial chemicals	281-82,286	57	3	12	4	6	3	7	5	6	6
Drugs and medicines	283	31	1	15	6	3	3	11	8	4	2
Other chemicals	284-85,287-89	99	5	35	5	6	1	6	1	1	0
Petroleum refining and related industries	29	13	0	4	2	1	0	6	4	12	8
Rubber products	30	54	0	28	2	5	3	3	1	4	2
Stone, clay, and glass products	32	48	0	24	2	4	2	11	5	2	2
Primary metals	33	54	0	50	6	10	3	9	3	13	6
Ferrous metals and products	331-32,3398-99	28	0	34	5	6	2	5	1	10	3
Nonferrous metals and products	333-36	26	0	16	1	4	1	4	2	3	3
Fabricated metal products	34	105	0	48	3	15	1	6	1	4	2
Machinery	35	323	4	123	8	28	7	24	6	12	2
Office, computing, and accounting machines	357	76	2	20	2	3	1	5	0	6	1
Other machinery, except electrical	351-56,358-59	247	2	103	6	25	6	19	6	6	1
Electrical equipment	36	296	5	93	6	26	1	20	4	16	9
Radio and TV receiving equipment	365	26	0	7	0	1	0	2	0	1	1
Communication equipment	366	70	1	14	0	5	0	3	2	6	3
Electronic components	367	75	1	27	3	8	1	5	1	3	2
Other electrical equipment	361-64,369	125	3	45	3	12	0	10	1	6	3
Motor vehicles and motor vehicles equipment	371	30	1	19	0	6	0	6	3	6	4
Other transportation equipment	373-75,379	8	0	12	0	1	0	5	1	2	1
Aircraft and missiles	372,376	18	0	14	1	3	0	7	3	11	6
Professional and scientific instruments	38	210	3	38	4	11	4	6	1	6	2
Scientific and mechanical measuring instruments	381-82	113	3	21	1	5	2	3	1	3	1
Optical, surgical, photographic, and other instruments	383-87	97	0	17	3	6	2	3	0	3	1
Other manufacturing industries	21,27,31,39	63	0	53	4	16	2	9	1	6	2
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	124	2	98	3	26	2	25	7	14	0

SOURCE: National Science Foundation.

Table B-34. Funds for applied research and development by product field: 1963-64, 1967-77, 1979, and 1981

[Dollars in millions]

Product field	SIC code	1963	1964	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1979	1981
Total	....	$12,108	$12,962	$15,757	$16,787	$17,690	$17,465	$17,730	$18,959	$20,618	$22,188	$23,457	$26,178	$28,914	$37,068	$50,189
Atomic energy devices[1]	--	609	709	675	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Food and kindred products	20	102	118	134	165	179	206	211	227	243	283	273	308	348	534	663
Textile mill products	22	(2)	(2)	55	58	66	55	60	83	93	82	73	81	96	(2)	(2)
Chemicals, except drugs and medicines	28, except 283	861	949	1,119	1,168	1,214	1,339	1,345	1,250	1,342	1,564	1,627	1,853	2,018	2,501	3,903
Industrial inorganic and organic chemicals	281,286	242	304	347	396	417	442	457	451	489	589	665	728	819	(2)	1,020
Plastics materials and synthetic resins, rubber, and fibers	282	379	402	474	466	482	521	511	453	511	589	588	674	744	881	1,315
Agricultural chemicals	287	45	48	92	99	104	126	130	108	114	137	176	205	236	292	487
Other chemicals	284-85, 289	196	195	205	207	210	223	218	238	229	248	198	246	220	(2)	1,081
Drugs and medicines	283	227	234	346	375	417	474	535	531	605	683	783	883	955	1,089	1,837
Petroleum refining and related industries	29	194	205	215	239	252	272	266	299	319	363	408	425	471	650	1,065
Rubber and miscellaneous plastics products	30	87	102	132	160	163	193	215	279	294	341	324	325	376	407	(2)
Stone, clay, and glass products	32	74	85	121	130	157	128	128	135	162	181	150	171	191	235	240
Primary metals	33	152	164	208	207	224	235	230	245	272	311	290	311	327	438	684
Ferrous metals and products	331-32, 3398-99	90	97	117	119	125	127	114	137	158	156	144	163	172	225	268
Nonferrous metals and products	333-36	62	68	91	88	99	108	116	108	114	155	147	148	155	213	416
Fabricated metal products	34, except 348	135	150	204	478	504	622	701	731	769	903	916	1,025	1.152	1,381	1,518
Ordnance and accessories, n.e.c.	348	92	94	218	201	186	192	192	177	228	222	187	199	288	316	453
Machinery	35	913	970	1,293	1,396	1,562	1,676	1,783	1,989	2,307	2,689	2,628	3,001	3.554	4,561	6,288
Engines and turbines	351	124	126	192	203	196	204	246	316	360	482	464	477	528	589	904
Farm machinery and equipment	352	76	79	102	96	99	89	90	93	120	131	138	168	221	295	231
Construction, mining, and materials handling machinery	353	58	60	119	129	154	182	196	206	265	283	285	317	376	632	569
Metalworking machinery and equipment	354	58	66	67	90	83	86	84	76	69	74	80	83	125	340	227
Office, computing, and accounting machines	357	412	458	614	678	812	863	903	1,028	1,219	1,422	1,339	1,580	1.849	1,961	3,220
Other machinery, except electrical	355-56, 358-59	185	182	199	201	218	252	264	270	274	297	322	376	455	744	1.137
Electrical equipment, except radio and TV receiving equipment, communication equipment, and electronic components	36, except 365-67;3825	277	305	3,053	3,363	3,409	3,372	688	775	857	929	774	874	901	980	1,724
Electric transmission and distribution equipment	361, 3825	47	46					181	189	204	239	205	224	224	191	(2)
Electrical industrial apparatus	362	77	84					187	231	263	264	260	306	298	291	(2)
Other electrical equipment and supplies	363-64, 368-69	152	175					320	355	390	426	309	344	379	498	653
Radio and TV receiving equipment, communication equipment, and electronic components	365-67	2,150	2,223					2,927	3,234	3,621	3,896	3,911	4,483	5.019	6,696	(2)
Motor vehicles and other transportation equipment	37, except 372,376	651	678	831	956	1,139	1,138	1,341	1,668	2,014	1,994	1,924	2,263	(2)	(2)	(2)
Motor vehicles and equipment	371	623	651	755	860	1,051	1,046	1,228	1,470	1,824	1,784	1,720	(2)	(2)	(2)	(2)
Other transportation equipment	373-75, 379	28	27	76	96	88	90	113	198	190	210	204	193	201	205	(2)
Aircraft and parts	372	[3]1,520	[3]1,670	2,165	2,370	2,579	2,556	2,486	2,396	2,548	2,420	2,265	2,733	3.113	3,460	4,924
Guided missiles and spacecraft	376	3,345	3,496	3,741	3,786	3,711	3,115	2,832	2,647	2,491	2,486	2,925	2,880	3.024	4,465	4,814
Professional and scientific instruments	38, except 3825	298	346	535	719	814	724	652	847	981	1,090	1,002	1,140	1.255	1,434	1,486
Other products fields, not elsewhere classified	—	[3]421	[3]463	710	1,013	1,124	1,194	1,177	1,440	1,465	1,742	2,987	3,179	3.201	4,062	5,657

[1] Distributed according to SIC code from 1968 to present.
[2] Not separately available but included in total. See general notes.
[3] Estimated by the National Science Foundation.

SOURCE: National Science Foundation.

39.

Table B-35. Funds for applied research and development by product field and source of funds: 1981

[Dollars in millions]

Product field	SIC code	Total	Federal	Company
Total	....	$50,189	$16,140	$34,049
Food and kindred products	20	663	(1)	(1)
Textile mill products	22	(1)	(1)	(1)
Chemicals, except drugs and medicines	28, except 283	3,903	101	3,802
Industrial inorganic and organic chemicals	281,286	1,020	24	996
Plastics materials and synthetic resins, rubber, and fibers	282	1,315	8	1,307
Agricultural chemicals	287	487	0	487
Other chemicals	284-85,289	1,081	69	1,012
Drugs and medicines	283	1,837	(1)	1,833
Petroleum refining and related industries	29	1,065	28	1,037
Rubber and miscellaneous plastics products	30	(1)	(1)	(1)
Stone, clay, and glass products	32	240	(1)	(1)
Primary metals	33	684	157	527
Ferrous metals and products	331-32,3398-99	268	8	260
Nonferrous metals and products	333-36	416	149	267
Fabricated metal products	34, except 348	1,518	889	629
Ordnance and accessories, n.e.c.	348	453	344	109
Machinery	35	6,288	483	5,805
Engines and turbines	351	904	140	764
Farm machinery and equipment	352	231	0	231
Construction, mining, and materials handling machinery	353	569	(1)	(1)
Metalworking machinery and equipment	354	227	(1)	(1)
Office, computing, and accounting machines	357	3,220	(1)	3,012
Other machinery, except electrical	356,358-59	(1)	119	(1)
Electrical equipment, except radio and TV receiving equipment, communication equipment, and electronic components	36, except 365-67; 3825	1,724	(1)	1,397
Electric transmission and distribution equipment	361,3825	(1)	(1)	(1)
Electrical industrial apparatus	362	(1)	(1)	(1)
Other electrical equipment and supplies	363-64,368-69	653	(1)	565
Radio and TV receiving equipment, communication equipment, and electronic components	365-67	(1)	(1)	(1)
Motor vehicles and other transportation equipment	37, except 372,376	(1)	(1)	(1)
Motor vehicles and equipment	371	(1)	(1)	(1)
Other transportation equipment	373-75,379	(1)	(1)	(1)
Aircraft and parts	372	4,924	2,258	2,666
Guided missiles and spacecraft	376	4,814	4,591	223
Professional and scientific instruments	38, except 3825	1,486	(1)	1,354
Other product fields, not elsewhere classified	-	5,657	2,653	3,004

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-36. Funds for applied research and development by industry and product field: 1981

[Dollars in millions]

Industry	SIC code	Total	Food and kindred products 20	Textile mill products 22	Chemicals, except drugs and medicines 28, except 283	Drugs and medicines 283	Petroleum refining 29	Rubber products 30	Stone, clay, and glass products 32	Primary metals 33	Fabricated metal products 34, except 348
Total	....	$50,189	$663	(1)	$3,903	$1,837	$1,065	(1)	$240	$684	$1,518
Food and kindred products	20	(1)	458	(1)	45	(1)	0	(1)	(1)	0	3
Textiles and apparel	22,23	123	0	86	(1)	0	0	(1)	0	0	0
Lumber, wood products, and furniture	24,25	(1)	(1)	(1)	15	0	0	(1)	0	0	7
Paper and allied products	26	(1)	0	(1)	46	0	0	(1)	0	0	(1)
Chemicals and allied products	28	4,786	103	37	2,402	1,559	35	90	(1)	(1)	105
Industrial chemicals	281-82,286	2,218	11	(1)	1,615	203	(1)	59	(1)	(1)	100
Drugs and medicines	283	(1)	(1)	0	(1)	1,301	0	(1)	(1)	(1)	(1)
Other chemicals	284-85,287-89	(1)	55	(1)	484	55	(1)	(1)	(1)	0	(1)
Petroleum refining and related industries	29	(1)	0	(1)	520	0	843	(1)	0	40	(1)
Rubber products	30	(1)	3	(1)	(1)	0	(1)	(1)	(1)	0	26
Stone, clay, and glass products	32	(1)	0	(1)	60	7	0	41	174	0	(1)
Primary metals	33	843	1	0	79	0	(1)	(1)	2	335	40
Ferrous metals and products	331-32,3398-99	527	0	0	23	0	0	(1)	(1)	225	27
Nonferrous metals and products	333-36	(1)	0	0	57	0	(1)	0	(1)	110	12
Fabricated metal products	34	630	(1)	0	79	0	0	(1)	(1)	11	235
Machinery	35	6,672	(1)	(1)	92	0	66	17	(1)	31	92
Office, computing, and accounting machines	357	(1)	(1)	0	(1)	0	0	0	(1)	3	1
Other machinery, except electrical	351-56,358-59	(1)	(1)	(1)	(1)	0	66	17	(1)	(1)	91
Electrical equipment	36	10,187	12	0	124	(1)	(1)	6	(1)	29	714
Radio and TV receiving equipment	365	(1)	0	0	0	0	0	(1)	0	0	0
Communication equipment	366	(1)	(1)	0	(1)	0	0	(1)	(1)	1	(1)
Electronic components	367	(1)	0	0	(1)	(1)	0	(1)	0	0	(1)
Other electrical equipment	361-64,369	(1)	(1)	0	77	(1)	(1)	(1)	(1)	28	690
Motor vehicles and motor vehicles equipment	371	(1)	0	0	97	0	0	21	5	17	88
Other transportation equipment	373-75,379	(1)	0	0	22	1	0	0	0	0	1
Aircraft and missiles	372,376	11,574	(1)	0	52	0	6	(1)	(1)	104	52
Professional and scientific instruments	38	3,645	(1)	10	(1)	(1)	42	(1)	(1)	(1)	(1)
Scientific and mechanical measuring instruments	381-82	(1)	0	0	(1)	0	42	0	(1)	0	(1)
Optical, surgical, photographic, and other instruments	383-87	(1)	(1)	(1)	(1)	(1)	0	(1)	(1)	(1)	(1)
Other manufacturing industries	21,27,31,39	(1)	(1)	(1)	12	0	2	(1)	(1)	(1)	10
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	1,959	(1)	(1)	77	0	42	(1)	(1)	39	(1)

See footnotes at end of table.

Table B-36. Funds for applied research and development by industry and product field: 1981--Continued

[Dollars in millions]

Industry	SIC code	Ordnance and accessories, n.e.c. 348	Machinery 35	Electrical equipment 36, except 365-67; 3825	Radio and TV receiving equipment, communication equipment, and electronic components 365-67	Motor vehicles and other transportation equipment 37, except 372,376	Aircraft and parts 372	Guided missiles and spacecraft 376	Professional and scientific instruments 38, except 3825	Other product fields, n.e.c. ....
Total	....	$453	$6,288	$1,724	(1)	(1)	$4,924	$4,814	$1,486	$5,657
Food and kindred products	20	0	22	(1)	(1)	0	0	0	0	105
Textiles and apparel	22,23	0	(1)	0	1	(1)	0	0	0	(1)
Lumber, wood products, and furniture	24,25	(1)	5	0	(1)	0	0	0	0	(1)
Paper and allied products	26	0	7	1	7	0	0	0	0	(1)
Chemicals and allied products	28	(1)	37	9	51	(1)	0	23	88	226
Industrial chemicals	281-82,286	(1)	(1)	7	43	(1)	0	23	43	110
Drugs and medicines	283	0	(1)	0	(1)	19	0	0	(1)	(1)
Other chemicals	284-85,287-89	0	10	(1)	(1)	0	0	0	(1)	90
Petroleum refining and related industries	29	18	36	7	39	(1)	0	0	3	(1)
Rubber products	30	(1)	(1)	15	87	(1)	(1)	0	0	60
Stone, clay, and glass products	32	0	9	2	(1)	12	(1)	32	(1)	(1)
Primary metals	33	(1)	57	3	20	14	35	155	0	83
Ferrous metals and products	331-32,3398-99	(1)	34	(1)	(1)	9	(1)	155	0	37
Nonferrous metals and products	333-36	0	23	(1)	(1)	5	(1)	0	0	46
Fabricated metal products	34	17	25	3	16	9	(1)	(1)	(1)	124
Machinery	35	88	4,098	191	1,064	102	88	84	15	637
Office, computing, and accounting machines	357	0	2,799	183	1,034	0	(1)	27	(1)	381
Other machinery, except electrical	351-56,358-59	88	1,298	(1)	(1)	102	(1)	57	(1)	256
Electrical equipment	36	113	337	999	5,663	98	728	660	105	555
Radio and TV receiving equipment	365	0	1	78	445	0	0	87	0	29
Communication equipment	366	20	(1)	538	3,047	(1)	(1)	(1)	11	357
Electronic components	367	(1)	(1)	186	1,057	(1)	(1)	0	(1)	(1)
Other electrical equipment	361-64,369	92	225	197	1,114	(1)	725	267	(1)	(1)
Motor vehicles and motor vehicles equipment	371	(1)	450	99	561	3,746	(1)	31	(1)	78
Other transportation equipment	373-75,379	(1)	(1)	8	47	(1)	0	0	0	(1)
Aircraft and missiles	372,376	19	293	(1)	(1)	106	3,813	3,441	61	1,662
Professional and scientific instruments	38	(1)	497	(1)	(1)	(1)	(1)	(1)	1,075	698
Scientific and mechanical measuring instruments	381-82	(1)	368	(1)	(1)	(1)	(1)	(1)	342	(1)
Optical, surgical, photographic, and other instruments	383-87	(1)	129	(1)	(1)	0	1	2	(1)	(1)
Other manufacturing industries	21,27,31,39	0	304	4	21	(1)	0	0	(1)	(1)
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	0	94	(1)	(1)	85	(1)	36	(1)	(1)

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-37. Funds for applied research and development by industry and secondary product field: 1981

[Dollars in millions]

Industry	SIC code	Chemicals, except drugs and medicines				Primary metals		Machinery	
		Industrial inorganic and organic chemicals 281,286	Plastics; synthetic resins, rubber, and fibers 282	Agricultural chemicals 287	Other chemicals 284-85, 289	Ferrous metals and products 331-32, 3398-99	Nonferrous metals and products 333-36	Engines and turbines 351	Farm machinery and equipment 352
Total		$1,020	$1,315	$487	$1,081	$268	$416	$904	$231
Food and kindred products	20	(1)	(1)	(1)	24	0	0	(1)	(1)
Textiles and apparel	22,23	0	(1)	0	0	0	0	0	0
Lumber, wood products, and furniture	24,25	0	12	2	(1)	0	0	0	0
Paper and allied products	26	(1)	(1)	0	(1)	0	0	0	0
Chemicals and allied products	28	594	708	388	712	(1)	69	(1)	0
Industrial chemicals	281-82,286	481	624	243	267	(1)	(1)	(1)	0
Drugs and medicines	283	38	(1)	(1)	(1)	0	(1)	0	0
Other chemicals	284-85,287-89	75	15	26	369	0	0	(1)	0
Petroleum refining and related industries	29	126	189	49	156	(1)	35	(1)	0
Rubber products	30	(1)	(1)	(1)	14	0	0	0	0
Stone, clay, and glass products	32	24	16	20	0	0	0	0	(1)
Primary metals	33	33	(1)	0	26	215	119	(1)	0
Ferrous metals and products	331-32,3398-99	7	(1)	0	(1)	215	9	(1)	0
Nonferrous metals and products	333-36	26	(1)	0	(1)	0	110	3	0
Fabricated metal products	34	23	34	(1)	20	(1)	9	(1)	(1)
Machinery	35	(1)	(1)	(1)	(1)	(1)	23	312	164
Office, computing, and accounting machines	357	(1)	(1)	0	(1)	3	0	0	25
Other machinery, except electrical	351-56,358-59	(1)	(1)	(1)	(1)	(1)	23	312	139
Electrical equipment	36	26	88	0	10	(1)	22	122	0
Radio and TV receiving equipment	365	0	0	0	0	0	0	0	0
Communication equipment	366	0	(1)	0	0	0	(1)	0	0
Electronic components	367	(1)	0	0	(1)	0	0	0	0
Other electrical equipment	361-64,369	(1)	(1)	0	(1)	(1)	(1)	122	0
Motor vehicles and motor vehicles equipment	371	11	72	0	15	(1)	7	344	(1)
Other transportation equipment	373-75,379	(1)	(1)	(1)	(1)	0	0	0	0
Aircraft and missiles	372,376	26	10	0	17	(1)	102	81	12
Professional and scientific instruments	38	(1)	(1)	(1)	(1)	0	(1)	0	0
Scientific and mechanical measuring instruments	381-82	(1)	(1)	0	(1)	0	0	0	0
Optical, surgical, photographic, and other instruments	383-87	3	(1)	(1)	(1)	0	(1)	0	0
Other manufacturing industries	21,27,31,39	(1)	3	0	(1)	0	(1)	0	0
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	(1)	(1)	0	25	(1)	25	(1)	0

See footnotes at end of table.

Table B-37. Funds for applied research and development by industry and secondary product field: 1981--Continued

[Dollars in millions]

Industry	SIC code	Machinery--Continued				Electrical equipment, except radio and TV receiving equipment, communication equipment, and electronic components			Motor vehicles and other transportation equipment	
		Construction, mining, and materials handling machinery 353	Metal-working machinery and equipment 354	Office, computing, and accounting machines 357	Other machinery, except electrical 355-56, 358-59	Electric transmission and distribution equipment 361, 3825	Electrical industrial apparatus 362	Other electrical equipment and supplies 363-64, 368-69	Motor vehicles and equipment 371	Other transportation equipment 373-75, 379
Total	....	$569	$227	$3,220	$1,137	(1)	(1)	$653	(1)	(1)
Food and kindred products	20	(1)	0	0	(1)	0	(1)	(1)	0	0
Textiles and apparel	22,23	0	0	0	(1)	0	(1)	(1)	1	0
Lumber, wood products, and furniture	24,25	0	0	0	5	0	0	(1)	0	0
Paper and allied products	26	0	0	0	(1)	0	0	1	0	0
Chemicals and allied products	28	(1)	0	0	28	(1)	7	(1)	(1)	(1)
Industrial chemicals	281-82,286	0	0	0	20	(1)	(1)	(1)	(1)	0
Drugs and medicines	283	0	0	0	(1)	0	(1)	(1)	0	(1)
Other chemicals	284-85,287-89	(1)	0	0	(1)	0	0	(1)	0	0
Petroleum refining and related industries	29	5	0	(1)	(1)	0	(1)	(1)	(1)	(1)
Rubber products	30	0	0	0	(1)	(1)	0	11	(1)	(1)
Stone, clay, and glass products	32	(1)	0	0	(1)	0	0	2	7	5
Primary metals	33	(1)	19	1	10	(1)	(1)	2	12	(1)
Ferrous metals and products	331-32,3398-99	0	8	1	(1)	0	(1)	0	(1)	(1)
Nonferrous metals and products	333-36	(1)	11	0	(1)	(1)	0	2	(1)	0
Fabricated metal products	34	3	2	0	11	(1)	(1)	(1)	(1)	(1)
Machinery	35	467	(1)	2,606	397	(1)	(1)	164	100	2
Office, computing, and accounting machines	357	8	(1)	(1)	91	(1)	(1)	160	0	0
Other machinery, except electrical	351-56,358-59	458	(1)	(1)	(1)	0	(1)	(1)	100	2
Electrical equipment	36	(1)	23	54	121	(1)	(1)	386	34	64
Radio and TV receiving equipment	365	0	0	(1)	0	5	2	(1)	0	0
Communication equipment	366	(1)	(1)	11	61	(1)	(1)	315	(1)	(1)
Electronic components	367	0	0	(1)	(1)	(1)	(1)	(1)	0	(1)
Other electrical equipment	361-64,369	(1)	(1)	22	57	(1)	(1)	(1)	(1)	18
Motor vehicles and motor vehicles equipment	371	12	(1)	(1)	39	5	6	88	3,727	18
Other transportation equipment	373-75,379	(1)	0	8	0	(1)	(1)	7	(1)	(1)
Aircraft and missiles	372,376	7	14	(1)	160	3	49	(1)	50	56
Professional and scientific instruments	38	(1)	(1)	466	23	7	22	(1)	(1)	0
Scientific and mechanical measuring instruments	381-82	(1)	(1)	(1)	8	(1)	(1)	47	(1)	0
Optical, surgical, photographic, and other instruments	383-87	(1)	0	(1)	14	0	0	(1)	0	0
Other manufacturing industries	21,27,31,39	0	(1)	2	(1)	0	(1)	(1)	(1)	(1)
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	45	0	(1)	(1)	197	14	(1)	77	(1)

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-38. Expenditures for energy research and development by selected industry: 1972-82 (projected)

[Dollars in millions]

Industry	SIC code	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982 (projected)
Total	....	$750	$1,009	$1,399	$1,774	$2,073	$2,573	$2,965	$3,643	$4,162	$4,270	$3,903
Food and kindred products	20	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	4	7	2
Textiles and apparel	22,23	0	0	0	0	1	(1)	(1)	(1)	(1)	(1)	2
Lumber, wood products, and furniture	24,25	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	3	4	5
Paper and allied products	26	(1)	(1)	(1)	(1)	(1)	1	2	3	3	4	2
Chemicals and allied products	28	52	47	71	102	121	148	157	220	257	296	297
Industrial chemicals	281-82,286	47	46	69	100	(1)	(1)	(1)	(1)	246	285	289
Drugs and medicines	283	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Other chemicals	284-85,287-89	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Petroleum refining and related industries	29	285	310	371	405	440	536	648	776	845	1,042	1,267
Rubber products	30	(1)	(1)	(1)	(1)	(1)	10	12	12	15	9	8
Stone, clay, and glass products	32	(1)	(1)	(1)	(1)	4	6	7	17	21	28	14
Primary metals	33	10	17	22	27	33	51	49	72	78	81	81
Ferrous metals and products	331-32,3398-99	(1)	(1)	(1)	(1)	12	19	14	19	20	18	19
Nonferrous metals and products	333-36	(1)	(1)	(1)	(1)	21	32	33	48	58	62	62
Fabricated metal products	34	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Machinery	35	8	11	16	23	40	61	80	83	108	151	173
Office, computing, and accounting machines	357	(1)	(1)	(1)	(1)	(1)	(1)	(1)	13	17	7	4
Other machinery, except electrical	351-56,358-59	(1)	(1)	(1)	(1)	(1)	(1)	(1)	70	91	144	169
Electrical equipment	36	194	318	389	464	585	650	714	843	917	918	906
Radio and TV receiving equipment	365	0	0	0	0	0	0	0	0	3	(1)	2
Communication equipment	366	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Electronic components	367	(1)	(1)	(1)	(1)	(1)	5	5	13	12	16	8
Other electrical equipment	361-64,369	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Motor vehicles and motor vehicles equipment	371	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Other transportation equipment	373-75,379	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Aircraft and missiles	372,376	65	111	142	134	110	165	283	372	446	432	300
Professional and scientific instruments	38	12	13	14	14	10	17	27	28	45	53	68
Scientific and mechanical measuring instruments	381-82	(1)	(1)	(1)	(1)	(1)	12	19	24	40	50	65
Optical, surgical, photographic, and other instruments	383-87	(1)	(1)	(1)	(1)	(1)	5	8	4	5	3	3
Other manufacturing industries	21,27,31,39	(1)	(1)	(1)	(1)	(1)	4	7	7	19	(1)	22
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	76	81	100	98	137	185	220	324	333	355	462

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-39. Company funds for energy research and development by selected industry: 1973-81

[Dollars in millions]

Industry	SIC code	1973	1974	1975	1976	1977	1978	1979	1980	1981
Total	....	$624	$857	$1,152	$1,319	$1,632	$1,796	$2,230	$2,599	$2,749
Textiles and apparel	22,23	0	0	0	1	1	1	1	1	2
Paper and allied products	26	(1)	(1)	(1)	(1)	1	2	3	3	4
Drugs and medicines	283	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Other chemicals	284-85,287-89	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Petroleum refining and related industries	29	(1)	(1)	(1)	(1)	469	530	623	699	945
Primary metals	33	(1)	(1)	(1)	(1)	37	30	48	55	59
Electrical equipment	36	74	96	115	122	165	137	219	205	211
Radio and TV receiving equipment	365	0	0	0	0	0	0	0	2	(1)
Other transportation equipment	373-75,379	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Aircraft and missiles	372,376	(1)	(1)	(1)	(1)	57	68	113	163	145
Scientific and mechanical measuring instruments	381-82	(1)	(1)	(1)	(1)	9	11	11	40	50
Other manufacturing industries	....	(1)	(1)	(1)	(1)	(1)	860	1,048	1,270	1,120
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	39	48	31	66	75	82	141	154	198

NOTE: Data not available for 1972.

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-40. Federal funds for energy research and development by selected industry: 1973-81

[Dollars in millions]

Industry	SIC code	1973	1974	1975	1976	1977	1978	1979	1980	1981
Total	....	$385	$482	$622	$754	$941	$1,169	$1,413	$1,563	$1,521
Textiles and apparel	22,23	0	0	0	0	(1)	(1)	(1)	1	(1)
Paper and allied products	26	(2)	(2)	(2)	(2)	0	0	0	0	1
Drugs and medicines	283	(2)	(2)	(2)	(2)	0	0	0	3	3
Other chemicals	284-85,287-89	(2)	(2)	(2)	(2)	0	0	0	0	0
Petroleum refining and related industries	29	(2)	(2)	(2)	(2)	67	118	153	146	97
Primary metals	33	(2)	(2)	(2)	(2)	15	19	24	23	22
Electrical equipment	36	244	293	349	463	485	577	624	711	706
Radio and TV receiving equipment	365	0	0	0	0	0	0	0	1	(1)
Other transportation equipment	373-75,379	(2)	(2)	(2)	(2)	0	(2)	(2)	(2)	(2)
Aircraft and missiles	372,376	(2)	(2)	(2)	(2)	108	215	259	283	287
Scientific and mechanical measuring instruments	381-82	(2)	(2)	(2)	(2)	0	0	0	0	0
Other manufacturing industries	....	(2)	(2)	(2)	(2)	(2)	164	201	216	247
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	42	52	67	71	110	139	183	179	157

NOTE: Data not available for 1972.

[1] Not separately available but included in total. See general notes.
[2] Less than $0.5 million.

SOURCE: National Science Foundation.

Table B-41. Industrial expenditures for energy research and development by primary energy source: 1972-82 (projected)

[Dollars in millions]

Primary energy source	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982 (projected)
Total	$750	$1,009	$1,339	$1,774	$2,073	$2,573	$2,965	$3,643	$4,162	$4,270	$3,903
Fossil fuels	(1)	438	516	550	605	757	843	1,063	1,228	1,449	1,636
Oil	(1)	297	329	333	381	[2]449	(1)	[2]557	(1)	778	855
Gas	(1)	51	74	66	68	[2]93	(1)	[2]113	(1)	210	260
Shale	(1)	12	18	19	24	[2]35	(1)	[2]24	(1)	57	122
Coal	(1)	49	65	109	127	[2]175	(1)	[2]313	(1)	387	386
Synthetic fossil fuels	(1)	(1)	21	50	74	[2]115	(1)	[2]236	(1)	212	261
Mining	(1)	(1)	5	9	10	[2]9	(1)	[2]1	(1)	31	20
Other	(1)	(1)	39	50	43	[2]51	(1)	[2]76	(1)	143	105
Other fossil fuels	(1)	29	30	23	5	[2]5	(1)	[2]56	(1)	17	13
Nuclear	(1)	501	601	700	799	926	995	1,037	1,056	1,046	1,094
Fission	(1)	476	567	659	741	[2]844	(1)	[2]913	(1)	874	864
Fusion	(1)	25	34	41	58	[2]82	(1)	[2]124	(1)	172	230
All other energy	(1)	70	222	524	669	890	1,127	1,543	1,878	1,775	1,173
Geothermal	(1)	1	2	6	13	[2]24	(1)	[2]149	(1)	72	28
Solar	(1)	2	7	19	43	[2]64	(1)	[2]321	(1)	304	213
Conservation and utilization	(1)	(1)	137	435	528	[2]687	(1)	[2]686	(1)	413	251
All other sources	(1)	67	76	64	85	[2]115	(1)	[2]387	(1)	986	681

[1] Data not collected.
[2] Detailed data for 1977 and 1979 were estimated based upon (a) data actually reported in those years, (b) revised data for years which were reported on the 1978 and 1980 survey forms, and (c) adjustments due to new sample in 1981.

SOURCE: National Science Foundation.

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Table B-42. Company funds for energy research and development by primary energy source: 1972-81

[Dollars in millions]

Primary energy source	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
Total	(1)	$624	$857	$1,152	$1,316	$1,632	$1,796	$2,230	$2,599	$2,749
Fossil fuels	(1)	[2]428	[2]503	[2]507	[2]523	644	678	788	993	1,260
Oil	(1)	295	[2]326	[2]327	[2]369	[3]436	(1)	[3]529	(1)	751
Gas	(1)	(4)	(4)	(4)	52	[3]73	(1)	[3]109	(1)	(4)
Shale	(1)	[2]12	(4)	(4)	(4)	[3](4)	(1)	[3](4)	(1)	(4)
Coal	(1)	42	56	77	80	[3]98	(1)	[3]130	(1)	241
Synthetic fossil fuels	(1)	(1)	(4)	(4)	48	[3]64	(1)	[3]84	(1)	130
Mining	(1)	(1)	(4)	(4)	7	[3]5	(1)	[3]1	(1)	24
Other	(1)	(1)	33	34	25	[3]29	(1)	[3]45	(1)	87
Other fossil fuels	(1)	(4)	(4)	(4)	(4)	[3](4)	(1)	[3](4)	(1)	16
Nuclear	(1)	135	157	160	198	217	217	169	150	152
Fission	(1)	127	[2]146	156	194	[3]211	(1)	[3]167	(1)	93
Fusion	(1)	7	11	4	4	[3]6	(1)	[3]2	(1)	59
All other energy	(1)	(4)	(4)	(4)	595	770	901	1,273	1,456	1,337
Geothermal	(1)	(4)	(4)	(4)	5	[3]9	(1)	[3]122	(1)	41
Solar	(1)	(4)	(4)	(4)	17	[3]22	(1)	[3]251	(1)	207
Conservation and utilization	(1)	(1)	[2]129	[2]425	[2]511	[3]656	(1)	[3]681	(1)	343
All other sources	(1)	59	62	46	62	[3]83	(1)	[3]219	(1)	746

[1] Data not collected.

[2] Revised by the National Science Foundation.

[3] Detailed data for 1977 and 1979 were estimated based upon (a) data actually reported in those years, (b) revised totals for those years which were reported on the 1978 and 1980 survey forms, and (c) adjustments due to new sample in 1981.

[4] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-43. Federal funds for energy research and development by primary energy source: 1972-81

[Dollars in millions]

Primary energy source	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
Total	(1)	$385	$482	$622	$757	$941	$1,169	$1,413	$1,563	$1,521
Fossil fuels	(1)	10	13	[2]43	[2]82	113	165	275	235	189
Oil	(1)	2	3	6	12	[3]13	(1)	[3]29	(1)	27
Gas	(1)	(4)	(4)	(4)	16	[3]20	(1)	[3]4	(1)	(4)
Shale	(1)	0	(4)	(4)	(4)	[3](4)	(1)	[3](4)	(1)	(4)
Coal	(1)	7	9	32	47	[3]77	(1)	[3]183	(1)	146
Synthetic fossil fuels	(1)	(1)	(4)	(4)	26	[3]51	(1)	[3]152	(1)	82
Mining	(1)	(1)	(4)	(4)	3	[3]4	(1)	[4]0	(1)	7
Other	(1)	(1)	6	16	18	[3]22	(1)	[3]31	(1)	56
Other fossil fuels	(1)	(4)	(4)	(4)	(4)	[3](4)	(1)	[3](4)	(1)	(4)
Nuclear	(1)	366	444	540	601	709	778	868	906	894
Fission	(1)	349	421	503	547	[3]633	(1)	[3]746	(1)	781
Fusion	(1)	18	23	37	54	[3]76	(1)	[3]122	(1)	113
All other energy	(1)	(4)	(4)	(4)	74	120	226	270	422	438
Geothermal	(1)	(4)	(4)	(4)	8	[3]15	(1)	[3]27	(1)	31
Solar	(1)	(4)	(4)	(4)	26	[3]42	(1)	[3]70	(1)	97
Conservation and utilization	(1)	(1)	8	10	17	[3]31	(1)	[3]5	(1)	70
All other sources	(1)	8	14	18	23	[3]32	(1)	[3]168	(1)	240

[1] Data not collected.

[2] Revised by the National Science Foundation.

[3] Detailed data for 1977 and 1979 were estimated based upon (a) data actually reported in those years, (b) revised totals for those years which were reported on the 1978 and 1980 survey forms, and (c) adjustments due to new sample in 1981.

[4] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

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Table B-44. Expenditures for pollution abatement research and development by industry: 1973-82 (projected)

[Dollars in millions]

Industry	SIC code	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982 (projected)
Total	....	$603	$657	$647	$754	$901	$1,065	$1,249	$1,202	(2)	(2)
Food and kindred products	20	4	3	3	3	3	2	2	3	2	2
Textiles and apparel	22,23	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	1	(2)
Lumber, wood products, and furniture	24,25	3	5	4	4	5	3	3	4	5	5
Paper and allied products	26	1	4	5	6	6	8	(1)	(1)	15	28
Chemicals and allied products	28	51	61	71	72	82	79	146	178	202	229
Industrial chemicals	281-82,286	38	39	56	58	64	67	128	157	180	205
Drugs and medicines	283	(1)	(1)	(1)	(1)	(1)	(1)	4	4	5	5
Other chemicals	284-85,287-89	(1)	(1)	(1)	(1)	(1)	(1)	13	16	18	19
Petroleum refining and related industries	29	51	61	65	58	60	71	80	95	92	99
Rubber products	30	0	0	2	2	2	3	3	3	(2)	(2)
Stone, clay, and glass products	32	4	7	5	4	6	7	9	11	10	6
Primary metals	33	9	13	24	31	29	25	29	30	25	25
Ferrous metals and products	331-32,3398-99	8	11	17	19	18	13	14	14	16	17
Nonferrous metals and products	333-36	1	3	7	12	12	12	15	15	9	9
Fabricated metal products	34	(1)	(1)	(1)	(1)	(1)	(1)	6	7	5	2
Machinery	35	14	25	23	29	32	38	31	30	29	29
Office, computing, and accounting machines	357	0	0	0	0	0	0	0	1	0	0
Other machinery, except electrical	351-56,358-59	14	25	23	29	31	37	30	29	29	29
Electrical equipment	36	13	16	19	18	20	19	34	39	40	33
Radio and TV receiving equipment	365	0	0	0	0	0	0	0	0	0	0
Communication equipment	366	(1)	(1)	(1)	5	6	6	5	6	(2)	(2)
Electronic components	367	0	(1)	(1)	(1)	(1)	(1)	(1)	(1)	1	(2)
Other electrical equipment	361-64,369	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(2)	(2)
Motor vehicles and motor vehicles equipment	371	380	384	347	413	487	593	(1)	(1)	(2)	(2)
Other transportation equipment	373-75,379	(1)	(1)	(1)	(1)	(1)	(1)	0	(1)	(2)	(2)
Aircraft and missiles	372,376	29	38	36	48	57	64	64	38	31	34
Professional and scientific instruments	38	(1)	(1)	(1)	(1)	3	4	3	(1)	(2)	(2)
Scientific and mechanical measuring instruments	381-82	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(2)	(2)
Optical, surgical, photographic, and other instruments	383-87	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(2)	(2)
Other manufacturing industries	21,27,31,39	2	2	1	2	3	3	2	3	(2)	(2)
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	36	29	34	55	101	140	145	141	130	109

[1] Not separately available but included in total. See general notes.

[2] Data not available due to high rate of imputation or because of disclosure policy.

SOURCE: National Science Foundation.

Table B-45. Expenditures for pollution abatement research and development by industry and source of funds: 1980-81

[Dollars in millions]

Industry	SIC code	1980			1981		
		Total	Federal	Company	Total	Federal	Company
Total	....	$1,202	$107	$1,095	(2)	$135	(2)
Food and kindred products	20	3	0	3	2	0	2
Textiles and apparel	22,23	(1)	0	(1)	1	0	1
Lumber, wood products, and furniture	24,25	4	0	4	5	0	5
Paper and allied products	26	(1)	0	9	15	0	15
Chemicals and allied products	28	178	48	130	202	61	141
Industrial chemicals	281-82,286	157	48	109	180	61	119
Drugs and medicines	283	4	0	4	5	0	5
Other chemicals	284-85,287-89	16	0	16	18	0	18
Petroleum refining and related industries	29	95	2	93	92	0	92
Rubber products	30	3	1	2	(2)	(2)	(2)
Stone, clay, and glass products	32	11	0	11	10	0	10
Primary metals	33	30	0	30	25	0	25
Ferrous metals and products	331-32,3398-99	14	0	14	16	0	16
Nonferrous metals and products	333-36	15	0	15	9	0	9
Fabricated metal products	34	7	0	7	5	1	4
Machinery	35	30	2	28	29	2	27
Office, computing, and accounting machines	357	1	0	1	0	0	0
Other machinery, except electrical	351-56,358-59	29	2	27	29	2	27
Electrical equipment	36	39	20	19	40	20	20
Radio and TV receiving equipment	365	0	0	0	0	0	0
Communication equipment	366	6	0	6	(2)	0	(2)
Electronic components	367	(1)	1	(1)	1	0	1
Other electrical equipment	361-64,369	(1)	19	(1)	(2)	20	(2)
Motor vehicles and motor vehicles equipment	371	(1)	1	(1)	(1)	2	(2)
Other transportation equipment	373-75,379	(1)	0	(1)	(2)	0	(2)
Aircraft and missiles	372,376	38	12	26	31	10	21
Professional and scientific instruments	38	(1)	(1)	(1)	(2)	(2)	(2)
Scientific and mechanical measuring instruments	381-82	(1)	(1)	(1)	(2)	0	(2)
Optical, surgical, photographic, and other instruments	383-87	(1)	(1)	(1)	(2)	(2)	(2)
Other manufacturing industries	21,27,31,39	3	0	3	(2)	0	(2)
Nonmanufacturing industries	07-17,41-67, 737,739,807,891	141	19	122	130	37	93

[1] Not separately available but included in total. See general notes.
[2] Data not available due to high rate of imputation or because of disclosure policy.

SOURCE: National Science Foundation.

Table B-46. Industrial expenditures for pollution abatement research and development by type of pollution: 1973-82 (projected)

[Dollars in millions]

Type of pollution	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982 (projected)
Total	$603	$657	$647	$754	$901	$1,065	$1,249	$1,202	(1)	(1)
Air	461	508	478	569	[2]676	(3)	[2]954	(3)	(1)	(1)
Automotive emission	(3)	383	348	426	[2]495	(3)	[2]736	(3)	(1)	(1)
Electric power plant emissions	(3)	25	28	31	[2]67	(3)	[2]70	(3)	79	63
All other	(3)	100	102	112	[2]114	(3)	[2]148	(3)	117	119
Water	76	60	71	84	[2]97	(3)	[2]120	(3)	110	120
Solid waste	10	14	23	21	[2]28	(3)	[2]44	(3)	101	118
Other	56	75	75	80	[2]100	(3)	[2]131	(3)	68	59

[1] Data not available due to high rate of imputation.
[2] Detailed data for 1977 and 1979 were estimated based upon (a) data actually reported in those years, (b) revised totals for those years which were reported on the 1978 and 1980 survey forms, and (c) adjustments due to new sample in 1981.
[3] Data not collected.

SOURCE: National Science Foundation.

Table B-47. Industrial expenditures for pollution abatement research and development by type of pollution and source of funds: 1980-81

[Dollars in millions]

Type of pollution	1980			1981		
	Total	Federal	Company	Total	Federal	Company
Total	$1,202	$107	$1,095	(1)	$135	(1)
Air	(2)	(2)	(2)	(1)	(1)	(1)
Automotive emission	(2)	(2)	(2)	(1)	(1)	(1)
Electric power plant emissions	(2)	(2)	(2)	79	7	72
All other	(2)	(2)	(2)	117	(1)	99
Water	(2)	(2)	(2)	110	8	102
Solid waste	(2)	(2)	(2)	101	62	39
Other	(2)	(2)	(2)	68	(1)	33

[1] Data not available due to high rate of imputation.
[2] Data not collected.

SOURCE: National Science Foundation.

Table B-48. Product versus process applied research and development by selected industry: 1981

[Dollars in millions]

Industry	SIC code	Total	Product	Process	Unclassifiable
Total	....	$50,189	$37,851	$6,518	$5,818
Chemicals and allied products	28	4,786	3,170	992	624
Machinery	35	(1)	(1)	(1)	(1)
Electrical equipment	36	10,187	7,027	966	2,194
Motor vehicles and motor vehicles equipment	371	(1)	(1)	(1)	(1)
Aircraft and missiles	372,376	11,574	10,665	602	307
All other manufacturing and nonmanufacturing	....	11,656	6,784	3,051	1,819

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-49. Company R&D expenditures to meet regulations by agency by selected industry: 1981[1]

[Dollars in millions]

Industry	SIC code	Coverage ratio[2]	Total	CPSC[3]	DOE[3]	EPA[3]	FAA[3]	FDA[3]	OSHA[3]	All other Federal	All other
Total	....	33	$2,537	$11	$1,817	$343	$22	$148	$30	$124	$42
Chemicals and allied products	28	39	517	2	296	66	0	131	17	4	1
Machinery	35	23	29	1	5	17	0	0	2	1	3
Electrical equipment	36	50	989	1	956	8	2	1	1	8	12
Motor vehicles and motor vehicles equipment	371	7	49	0	6	25	0	0	0	15	3
Aircraft and missiles	372,376	62	269	3	220	15	19	0	2	9	1
All other manufacturing and nonmanufacturing industries	....	26	684	5	334	212	0	16	8	87	22

Note: This table lists only R&D funds actually reported by those companies responding to this new question on the survey. No attempt has been made to estimate national totals.

[1] Companies were asked to list only those funds spent for research and development which would not have been spent in the absence of those regulations.
[2] The percent of total company R&D funds represented by the firms which responded to this question.
[3] CPSC: Consumer Product Safety Commission; DOE: Department of Energy; EPA: Environmental Protection Agency; FAA: Federal Aviation Administration; FDA: Food and Drug Administration; OSHA: Occupational Safety and Health Administration.

SOURCE: National Science Foundation.

Table B-50. Geographic distribution of funds for industrial research and development: 1963, 1966-77, 1979, and 1981

[Dollars in millions]

Area	1963	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1979	1981
United States	$12,630	$15,548	$16,385	$17,429	$18,308	$18,067	$18,320	$19,552	$21,249	$22,887	$24,187	$26,997	$29,825	$38,226	$51,830
Northeast	3,818	5,092	5,438	5,867	6,095	6,333	6,510	6,869	6,735	7,291	7,403	8,096	8,687	10,296	14,270
New England	993	1,494	1,661	1,870	1,835	1,854	1,884	1,929	2,011	2,058	2,029	2,147	2,400	3,003	3,855
Maine	4	5	8	9	6	10	9	10	8	8	9	21	24	40	(1)
New Hampshire	6	27	49	43	49	49	52	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Vermont	6	15	14	20	32	34	61	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Massachusetts	481	826	915	986	977	1,004	1,082	1,141	1,135	1,080	1,022	1,156	1,349	1,690	1,907
Rhode Island	7	9	14	17	45	52	51	43	44	41	45	22	24	49	87
Connecticut	489	612	663	795	726	705	629	637	732	821	832	815	876	985	1,514
Middle Atlantic	2,825	3,598	3,777	3,997	4,260	4,479	4,626	4,940	4,724	5,233	5,374	5,949	6,287	7,293	10,415
New York	1,176	1,573	1,718	1,830	1,981	2,038	2,066	2,201	1,971	2,134	2,225	2,418	2,542	2,959	4,057
New Jersey	958	1,119	1,098	1,117	1,202	1,292	1,403	1,558	1,407	1,512	1,547	1,717	1,900	2,191	3,355
Pennsylvania	691	906	911	1,050	1,077	1,149	1,157	1,181	1,347	1,537	1,602	1,814	1,845	2,143	3,003
North Central	2,791	3,382	3,638	3,766	4,216	4,393	4,849	5,414	5,468	5,756	5,821	6,574	7,777	10,013	12.692
East North Central	2,230	2,857	3,157	3,291	3,570	3,624	3,837	4,314	4,424	4,704	4,816	5,390	6,270	8,065	9,742
Ohio	583	774	879	910	925	982	945	984	1,043	1,103	1,139	1,183	1,323	1,635	1,781
Indiana	236	316	377	386	431	428	448	459	387	403	453	469	541	723	1,054
Illinois	398	539	612	625	680	731	796	855	862	970	1,042	1,226	1,360	1,673	2,077
Michigan	862	1,049	1,089	1,162	1,305	1,259	1,413	1,733	1,883	2,016	1,961	2,249	2,750	3,614	4,272
Wisconsin	149	179	201	208	229	224	235	283	249	212	221	263	296	420	558
West North Central	562	525	480	475	646	769	1,012	1,100	1,044	1,052	1,005	1,184	1,507	1,948	2.950
Minnesota	149	225	239	250	298	289	294	332	341	411	403	551	602	802	1,180
Iowa	58	103	75	71	87	138	138	136	158	175	182	144	173	150	393
Missouri	304	156	125	99	211	(1)	(1)	569	484	399	350	398	630	746	1,137
North Dakota	0	0	0	0	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
South Dakota	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Nebraska	(1)	(1)	(1)	(1)	(1)	(1)	(1)	11	7	10	9	13	14	15	28
Kansas	47	30	34	45	41	50	36	49	49	51	60	76	84	216	211
South	1,701	2,437	2,414	2,531	2,488	2,341	2,472	2,450	2,601	2,891	2,964	3,442	3,691	4,496	6,987
South Atlantic	931	1,179	1,220	1,304	1,466	1,424	1,612	1,546	1,666	1,775	1,720	1,847	2,012	2,592	4,012
Delaware	26	41	37	26	34	51	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Maryland	241	275	254	310	301	361	369	386	423	481	446	452	382	424	(1)
District of Columbia	12	19	23	47	30	31	21	24	10	24	14	8	8	33	(1)
Virginia	93	(1)	(1)	(1)	(1)	(1)	133	131	194	244	236	264	318	464	539
West Virginia	89	59	63	61	54	48	40	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
North Carolina	71	124	120	138	157	175	140	143	203	227	235	253	268	327	546
South Carolina	28	47	48	51	59	65	(1)	58	38	30	37	87	96	82	(1)
Georgia	61	(1)	(1)	(1)	(1)	(1)	122	91	73	83	81	91	99	147	220
Florida	284	338	375	436	424	371	422	353	386	374	348	398	462	620	1,449
East South Central	280	487	473	416	364	346	342	327	356	388	401	427	467	402	624
Kentucky	22	41	48	51	53	55	52	61	73	67	74	79	100	209	170
Tennessee	139	206	221	199	194	183	191	181	190	231	261	282	306	(1)	(1)
Alabama	116	238	203	164	114	105	96	81	84	79	57	56	48	62	100
Mississippi	2	2	2	2	3	3	3	4	8	8	10	10	13	(1)	(1)
West South Central	491	771	721	811	658	571	519	577	579	728	843	1,113	1,212	1,502	2,351
Arkansas	2	5	5	6	5	7	5	5	4	9	13	12	10	11	52
Louisiana	131	237	154	127	103	38	51	66	55	74	88	98	106	83	158
Oklahoma	53	99	83	71	73	81	63	82	72	76	99	116	142	174	339
Texas	304	430	479	607	477	445	400	424	448	567	643	887	954	1,233	(1)
West	4,320	4,635	4,897	5,264	5,509	5,000	4,489	4,819	5,275	5,620	6,165	6,855	7,379	10,176	11,873
Mountain	465	446	489	596	651	687	570	576	621	622	782	923	1,034	1,139	2,135
Montana	(1)	(1)	(1)	(1)	0	0	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Idaho	27	(1)	(1)	(1)	(1)	(1)	30	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Wyoming	1	2	2	2	3	3	5	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Colorado	126	108	119	139	149	217	140	130	146	166	194	250	257	269	529
New Mexico	(1)	146	154	151	179	179	(1)	163	149	(1)	(1)	(1)	(1)	(1)	(1)
Arizona	86	116	125	180	197	152	155	171	212	199	243	203	200	372	758
Utah	71	18	21	21	25	22	17	26	43	61	91	112	132	142	265
Nevada	(1)	38	52	55	37	37	(1)	(1)	(1)	8	11	35	72	(1)	(1)
Pacific	3,854	4,189	4,407	4,668	4,858	4,313	3,919	4,243	4,654	4,958	5,384	5,932	6,345	9,037	9,738
Washington	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	484	499	610	681	(1)	(1)
Oregon	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	50	51	57	77	116	(1)
California	3,512	(1)	(1)	(1)	(1)	3,800	3,468	3,710	4,241	4,423	4,834	5,263	5,600	7,437	7,626
Alaska	0	0	0	0	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Hawaii	(1)	(1)	(1)	(1)	(1)	(1)	3	2	2	1	(1)	(1)	(1)	(1)	(1)
Undistributed funds	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	1,146	1,302	1,803	2,030	2,291	3,245	(1)

[1] Not separately available but included in total. See general notes.

[2] For 1963-72 these funds were allocated to individual States based on each share of total research and development and are included in regional and U.S. totals.

Table B-51. Geographic distribution of funds for industrial research and development by source of funds: 1981

[Dollars in millions]

Area	Total	Federal	Company
United States	$51,830	$16,468	$35,362
Northeast	14,270	3,456	10,814
New England	3,855	1,638	2,217
Maine	(1)	(1)	(1)
New Hampshire	(1)	(1)	(1)
Vermont	(1)	0	(1)
Massachusetts	1,907	810	1,097
Rhode Island	87	(1)	(1)
Connecticut	1,514	664	851
Middle Atlantic	10,415	1,818	8,597
New York	4,057	539	3,518
New Jersey	3,355	506	2,849
Pennsylvania	3,003	773	2,230
North Central	12,692	2,108	10,992
East North Central	9,742	715	9,027
Ohio	1,781	237	1,544
Indiana	1,054	191	863
Illinois	2,077	(1)	2,064
Michigan	4,272	(1)	(1)
Wisconsin	558	(1)	(1)
West North Central	2,950	1,393	1,965
Minnesota	1,180	(1)	770
Iowa	393	74	319
Missouri	1,137	(1)	(1)
North Dakota	(1)	0	(1)
South Dakota	(1)	0	(1)
Nebraska	28	(1)	(1)
Kansas	211	(1)	(1)
South	6,987	2,253	4,734
South Atlantic	4,012	1,417	2,595
Delaware	(1)	(1)	(1)
Maryland	(1)	(1)	(1)
District of Columbia	(1)	(1)	(1)
Virginia	539	313	226
West Virginia	(1)	(1)	(1)
North Carolina	546	(1)	(1)
South Carolina	(1)	(1)	(1)
Georgia	220	(1)	(1)
Florida	1,449	562	887
East South Central	624	145	479
Kentucky	170	(1)	(1)
Tennessee	(1)	38	(1)
Alabama	100	71	29
Mississippi	(1)	(1)	(1)
West South Central	2,351	691	1,660
Arkansas	52	0	52
Louisiana	158	26	132
Oklahoma	339	(1)	(1)
Texas	(1)	(1)	(1)
West	11,873	7,346	4,527
Mountain	2,135	1,390	745
Montana	(1)	0	(1)
Idaho	(1)	(1)	(1)
Wyoming	(1)	0	(1)
Colorado	529	134	395
New Mexico	(1)	706	(1)
Arizona	758	240	518
Utah	265	(1)	(1)
Nevada	(1)	(1)	(1)
Pacific	9,738	5,956	3,782
Washington	(1)	1,181	(1)
Oregon	(1)	(1)	(1)
California	7,626	4,767	2,859
Alaska	(1)	0	(1)
Hawaii	(1)	7	(1)
Undistributed funds	(1)	(1)	(1)

[1] Not separately available but included in total. See general notes.

Source: National Science Foundation.

Table B-52. Distribution of R&D costs by industry and type of cost: 1981

[Dollars in millions]

Industry	SIC code	Coverage ratio[1]	R&D costs	Wages of R&D personnel	Materials and supplies	Overhead costs
Total	....	.67	$51,830	$23,833	$9,896	$18,101
Food and kindred products	20	.60	719	406	99	214
Textiles and apparel	22,23	.62	124	75	22	27
Lumber, wood products, and furniture	24,25	.53	167	(2)	36	(2)
Paper and allied products	26	.85	(2)	300	(2)	183
Chemicals and allied products	28	.62	5,325	2,799	(2)	1,645
Industrial chemicals	281-82,286	.68	2,553	(2)	(2)	742
Drugs and medicines	283	.51	(2)	(2)	(2)	624
Other chemicals	284-85,287-89	.69	(2)	402	(2)	279
Petroleum refining and related industries	29	.62	(2)	822	(2)	775
Rubber products	30	.40	(2)	(2)	(2)	(2)
Stone, clay, and glass products	32	.74	(2)	215	(2)	185
Primary metals	33	.83	889	409	169	312
Ferrous metals and products	331-32,3398-99	.84	(2)	242	(2)	197
Nonferrous metals and products	333-36	.81	(2)	167	(2)	115
Fabricated metal products	34	.74	638	297	121	220
Machinery	35	.78	6,800	3,233	984	2,584
Office, computing, and accounting machines	357	.85	(2)	2,012	(2)	1,956
Other machinery, except electrical	351-56,358-59	.78	(2)	1,221	(2)	628
Electrical equipment	36	.72	10,466	4,889	2,092	3,484
Radio and TV receiving equipment	365	.86	(2)	787	(2)	212
Communication equipment	366	.80	4,737	2,185	746	1,806
Electronic components	367	.45	1,659	(2)	(2)	(2)
Other electrical equipment	361-64,369	.71	(2)	1,679	(2)	867
Motor vehicles and motor vehicles equipment	371	.93	4,929	2,578	1,090	1,262
Other transportation equipment	373-75,379	.69	(2)	67	(2)	51
Aircraft and missiles	372,376	.61	11,702	3,885	2,771	5,047
Professional and scientific instruments	38	.31	3,685	(2)	(2)	(2)
Scientific and mechanical measuring instruments	381-82	.35	(2)	(2)	(2)	(2)
Optical, surgical, photographic, and other instruments	383-87	.24	(2)	(2)	297	(2)
Other manufacturing industries	21,27,31,39	.43	393	(2)	(2)	(2)
Nonmanufacturing industries	07-17,41-67, 737,739,807,891	.59	(2)	(2)	(2)	(2)

[1] The coverage ratio is derived by dividing R&D funds for which a distribution by type of cost was reported by total R&D funds, including those for which a distribution was not reported.

[2] Not separately available but included in total. See general notes.

Source: National Science Foundation.

Table B-53. Full-time-equivalent number of R&D scientists and engineers by industry and size of company: 1957-58, 1963-64, 1967-68 and 1971-82

[In thousands]

Industry and size of company	SIC code	January																	
		1957	1958	1963	1964	1967	1968	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Total	....	229.4	234.8	327.3	340.2	367.2	376.7	367.0	350.2	357.7	360.0	363.3	364.4	382.8	404.4	423.9	450.6	487.8	511.6
Distribution by industry																			
Food and kindred products	20	3.8	4.8	5.1	5.7	6.1	6.3	6.6	6.5	6.6	6.4	6.8	6.9	6.9	6.9	7.4	7.2	7.4	7.6
Textile and apparel	22,23	.7	.8	1.0	1.2	1.9	2.5	1.8	1.8	1.9	1.8	1.8	1.8	1.7	1.8	1.8	(1)	2.0	2.0
Lumber, wood products, and furniture	24,25	.8	.8	.5	.5	.5	.5	1.8	1.8	1.9	2.1	2.3	2.1	2.1	2.0	1.8	1.7	1.6	(1)
Paper and allied products	26	1.5	1.7	2.5	3.8	4.7	4.8	5.0	4.9	4.9	4.9	5.0	5.2	6.3	6.5	7.1	7.4	8.0	8.5
Chemicals and allied products	28	29.4	31.0	38.3	35.8	36.9	38.9	42.7	41.0	40.9	41.8	45.2	44.4	46.4	48.3	50.0	51.4	54.7	60.0
Industrial chemicals	281-82,286	18.0	18.8	22.9	22.2	21.7	22.3	21.8	19.1	19.1	19.1	21.1	20.1	20.6	21.3	21.4	20.9	21.6	24.3
Drugs and medicines	283	4.7	5.1	6.9	6.9	8.7	9.8	12.3	13.1	13.0	14.0	15.6	16.6	17.8	19.5	20.8	21.6	23.3	25.3
Other chemicals	284-85,287-89	6.7	7.1	8.5	6.7	6.5	6.8	8.6	8.8	8.8	8.7	8.5	7.8	8.0	7.5	7.8	8.9	9.8	10.4
Petroleum refining and related industries	29	6.9	7.4	8.9	8.1	8.7	9.2	9.2	8.3	8.2	8.2	8.4	8.6	8.9	9.9	10.1	10.8	13.0	15.9
Rubber products	30	4.7	4.7	5.8	6.0	5.8	6.1	6.7	6.7	7.5	7.7	8.4	8.6	9.1	7.9	8.1	(1)	10.3	(1)
Stone, clay, and glass products	32	(2)	(2)	3.8	3.3	3.3	4.1	4.3	4.1	4.2	4.5	4.5	4.6	4.5	5.1	5.2	5.4	5.6	5.8
Primary metals	33	5.1	5.2	5.2	5.1	5.9	5.9	6.6	6.4	6.0	6.4	6.3	8.1	8.4	8.1	7.9	8.1	7.9	8.8
Ferrous metals and products[3]	331-32,3398-99	2.9	3.0	2.9	2.8	3.3	3.1	3.4	3.4	3.2	3.3	3.3	3.9	3.9	4.2	4.3	4.7	4.8	5.5
Nonferrous metals and products[3]	333-36	2.2	2.2	2.3	2.3	2.5	2.7	3.2	3.0	2.8	3.1	3.0	4.2	4.5	3.9	3.6	3.4	3.1	3.3
Fabricated metal products	34	8.4	8.3	6.8	7.0	6.3	5.6	7.1	6.6	6.7	7.3	7.4	6.8	7.1	7.0	6.8	7.8	7.8	7.5
Machinery	35	24.9	27.4	31.4	27.3	33.6	37.4	42.7	43.7	46.3	51.0	52.8	55.7	55.3	57.8	60.2	62.1	69.2	73.1
Office, computing, and accounting machines	357	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	30.1	34.5	36.1	38.1	37.7	38.9	40.9	41.8	43.7	47.1
Other machinery, except electrical	351-56,358-59	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	18.9	19.3	20.3	25.5	26.0
Electrical equipment	36	42.9	47.9	85.8	89.5	98.6	98.4	91.8	83.6	85.4	82.6	82.6	80.3	84.1	84.4	85.0	94.5	106.9	113.0
Radio and TV receiving equipment	365	(6)	(6)	(6)	(6)	.9	1.0	2.4	2.1	1.4	1.3	1.0	1.1	.9	1.5	2.1	4.0	7.9	8.1
Communication equipment	366	19.2	22.3	55.1	60.4	66.7	67.4	60.3	53.2	45.3	42.0	40.2	37.4	38.0	39.0	40.4	42.4	44.2	48.0
Electronic components	367									9.4	9.6	10.6	10.2	13.0	14.2	14.0	18.1	22.8	23.5
Other electrical equipment	361-64,369	23.7	25.6	30.7	29.1	31.0	30.0	29.1	28.3	29.3	29.7	30.8	31.6	32.2	29.7	28.5	30.0	32.0	33.4
Motor vehicles and motor vehicles equipment	371	13.6	15.0	21.1	23.3	25.2	24.3	28.2	29.7	28.2	27.4	26.0	25.4	28.2	31.9	35.2	38.2	35.1	34.6
Other transportation equipment	373-75,379									1.7	1.8	1.9	1.7	2.9	1.9	2.0	1.5	1.4	1.5
Aircraft and missiles	372,376	58.7	58.6	90.7	101.1	100.4	101.1	78.2	70.8	72.1	70.6	67.5	66.9	72.0	82.0	86.5	85.9	95.2	95.3
Professional and scientific instruments	38	10.2	11.0	9.4	10.8	13.0	14.1	15.1	15.2	16.3	17.5	17.9	18.8	20.5	23.3	27.0	32.8	34.7	39.1
Scientific and mechanical measuring instruments	381-82	5.8	6.5	3.9	3.8	3.6	3.8	4.6	4.7	5.3	5.6	5.9	6.7	7.2	9.0	11.7	(1)	18.6	(1)
Optical, surgical, photographic, and other instruments	383-87	4.4	4.5	5.5	7.0	9.4	10.3	10.5	10.5	11.0	11.9	12.0	12.1	13.3	14.3	15.3	16.3	16.0	16.2
Other manufacturing industries	21,27,31,39	17.8	19.2	2.8	2.0	2.2	2.4	3.8	3.6	3.6	3.7	3.7	4.2	4.5	4.6	4.7	4.6	4.8	4.5
Nonmanufacturing industries	07-17,41-67,737, 739,807,891			8.2	9.8	14.1	15.1	15.6	15.7	15.3	14.4	14.9	14.6	15.3	15.0	17.1	19.8	22.2	22.9
Distribution by size of company (based on number of employees)																			
Less than 1,000	....	44.8	48.8	34.1	32.5	27.4	27.2	28.2	28.4	29.0	28.0	30.1	30.2	31.1	29.5	30.5	34.4	38.0	41.2
1,000 to 4,999	....	22.4	24.0	35.0	34.5	30.5	29.9	31.8	30.9	28.9	28.8	29.9	29.3	28.9	27.5	30.9	34.8	38.9	40.1
5,000 to 9,999	....	162.2	171.0	258.2	273.2	24.0	24.6	28.7	28.4	27.0	26.4	27.4	26.1	28.6	28.7	30.7	29.6	27.2	29.3
10,000 to 24,999	....					285.3	295.0	278.3	262.5	45.1	45.9	47.4	50.6	49.3	52.1	55.6	64.4	71.8	75.8
25,000 or more	....									227.7	230.9	228.5	228.2	244.9	266.6	276.2	287.4	311.8	325.2

[1] Not separately available but included in total. See general notes.
[2] Data included in the other manufacturing industries group.
[3] SIC codes 3398 and 3399 included in the nonferrous metals and products group for January 1957-64.
[4] Data not tabulated at this level prior to the 1972 survey.
[5] Data not tabulated at this level prior to the 1977 survey.
[6] Included in the other electrical equipment group.

SOURCE: National Science Foundation.

Table B-54. Full-time-equivalent number of scientists and engineers by industry and source of R&D funds: January 1982

Industry	SIC code	Total	Federal	Company
Total		511,600	130,600	381,000
Food and kindred products	20	7,600	(1)	(1)
Textiles and apparel	22,23	2.000	0	2,000
Lumber, wood products, and furniture	24,25	(1)	0	(1)
Paper and allied products	26	8,500	0	8,500
Chemicals and allied products	28	60,000	3,200	56,800
Industrial chemicals	281-82,286	24,300	2,800	21,500
Drugs and medicines	283	25,300	(1)	(1)
Other chemicals	284-85,287-89	10,400	(1)	(1)
Petroleum refining and related industries	29	15,900	(1)	(1)
Rubber products	30	(1)	(1)	(1)
Stone, clay, and glass products	32	5,800	(1)	(1)
Primary metals	33	8,800	1,200	7,600
Ferrous metals and products	331-32,3398-99	5,500	(1)	(1)
Nonferrous metals and products	333-36	3,300	(1)	(1)
Fabricated metal products	34	7,500	(1)	(1)
Machinery	35	73,100	5,000	68,000
Office, computing, and accounting machines	357	47,100	(1)	(1)
Other machinery, except electrical	351-56,358-59	26,000	(1)	(1)
Electrical equipment	36	113,000	39,800	73,300
Radio and TV receiving equipment	365	8,100	(1)	(1)
Communication equipment	366	48,000	(1)	(1)
Electronic components	367	23,500	(1)	(1)
Other electrical equipment	361-64,369	33,400	13,400	20,000
Motor vehicles and motor vehicles equipment	371	34,600	6,300	28,300
Other transportation equipment	373-75,379	1,500	700	800
Aircraft and missiles	372,376	95,300	52,800	42,400
Professional and scientific instruments	38	39,100	4,300	34,800
Scientific and mechanical measuring instruments	381-82	(1)	(1)	(1)
Optical, surgical, photographic, and other instruments	383-87	16,200	(1)	(1)
Other manufacturing industries	21,27,31,39	4,500	0	4,500
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	22,900	(1)	(1)

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-55. Cost per R&D scientist or engineer by industry and size of company: 1957-58, 1963, 1967, and 1970-81

Industry and size of company	SIC code	1957	1958	1963	1967	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
Total		$32,700	$32,800	$37,800	$44,100	$48,100	$51,100	$55,300	$59,200	$63,300	$66,500	$72,200	$75,800	$80,400	$87,400	$94,900	$103,700
Distribution by industry																	
Food and kindred products	20	17,200	16,800	25,200	29,500	35,400	36,600	39,500	41,400	45,200	48,900	51,400	60,100	66,000	72,300	84,900	95,900
Textiles and apparel	22,23	20,000	28,900	26,400	25,900	24,700	32,800	32,100	34,900	38,300	38,900	46,900	47,400	49,400	53,200	57,500	62.000
Lumber, wood products, and furniture	24,25	17,500	13,300	22,000	24,000	34,700	29,400	33,700	35,500	38,200	40,000	51,000	60,000	66,300	79,400	89,700	(1)
Paper and allied products	26	21,900	22,700	27,000	26,900	36,000	37,800	38,600	38,900	47,900	48,800	54,400	52,000	56,900	61,400	64,300	(1)
Chemicals and allied products	28	23,300	24,600	32,600	39,800	42,800	43,700	47,100	51,100	56,300	60,900	66,500	67,600	72,800	79,600	87,400	92,900
Industrial chemicals	281-82,286	27,400	28,400	34,800	43,900	47,500	49,200	54,000	58,600	63,500	67,500	74,700	79,600	84,200	92,800	103,400	111,200
Drugs and medicines	283	21,200	23,300	30,200	37,100	40,100	43,200	46,500	51,500	54,300	60,900	63,400	59,900	64,800	71,400	79,200	(1)
Other chemicals	284-85,287-89	14,200	15,300	27,900	29,800	33,400	35,500	33,400	34,000	45,300	43,200	50,800	53,800	61,600	66,500	66,500	(1)
Petroleum refining and related industries	29	29,500	32,600	35,400	41,500	53,900	57,700	57,100	60,400	74,900	81,500	87,200	97,700	106,000	120,800	130,400	(1)
Rubber products	30	22,800	18,700	26,500	30,600	38,900	43,100	53,100	56,100	58,300	54,900	56,700	57,800	61,600	(1)	(1)	(1)
Stone, clay, and glass products	32	(2)	(2)	26,000	36,800	37,100	39,000	43,600	45,200	48,200	51,200	57,800	59,800	62,900	67,200	73,800	(1)
Primary metals	33	21,000	24,000	35,700	41,000	41,700	41,800	44,700	49,500	55,900	61,500	61,300	65,200	70,000	79,300	91,000	106,500
Ferrous metals and products[3]	331-32,3398-99	21,700	24,600	37,400	42,200	45,200	42,400	44,200	50,200	54,800	59,700	65,600	70,100	73,900	83,300	93,300	(1)
Nonferrous metals and products[3]	333-36	20,000	23,200	33,500	41,200	38,200	41,300	44,800	48,300	57,100	63,300	57,500	60,500	65,600	74,000	87,700	(1)
Fabricated metal products	34	16,200	18,800	22,200	27,400	31,800	35,100	37,800	41,600	42,300	45,600	51,500	54,800	55,700	62,300	70,500	83,400
Machinery	35	25,600	27,500	31,000	37,400	40,700	43,100	48,000	52,400	57,500	58,900	62,800	68,600	72,600	78,900	89,900	95,600
Office, computing, and accounting machines	357	(4)	(4)	(4)	(4)	(4)	(4)	48,500	53,700	59,600	59,800	63,400	69,300	72,300	77,700	92,700	(1)
Other machinery, except electrical	351-56,358-59	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(1)	73,300	81,400	84,700	(1)
Electrical equipment	36	39,700	38,200	33,000	39,300	43,900	50,100	55,400	58,400	60,700	62,700	68,600	69,900	76,800	87,200	91,100	95,200
Radio and TV receiving equipment	365	(6)	(6)	(6)	47,400	32,600	28,400	26,700	37,500	44,300	47,600	52,000	96,000	72,200	80,300	93,400	(1)
Communication equipment	366	36,000	34,600	31,700	36,200	41,600	48,200	57,800	59,800	59,000	61,300	66,100	70,800	75,500	87,800	92,900	102,800
Electronic components	367							33,700	42,700	48,400	52,700	59,600	56,600	64,000	72,800	75,600	71,700
Other electrical equipment	361-64,369	42,800	41,900	35,400	45,800	49,100	55,300	59,700	62,200	67,700	68,000	74,700	74,200	85,100	94,900	98,300	(1)
Motor vehicles and motor vehicles equipment	371	49,400	53,800	49,400	54,700	59,600	58,900	68,100	86,500	89,500	91,100	103,700	111,700	115,600	122,900	135,200	141,400
Other transportation equipment	373-75,379							32,900	40,000	45,800	50,000	52,200	63,200	67,200	90,900	111,700	(1)
Aircraft and missiles	372,376	43,900	41,900	49,600	56,300	61,300	65,500	69,200	70,800	76,400	85,100	91,300	91,300	89,400	93,300	101,600	122,900
Professional and scientific instruments	38	23,500	25,600	29,900	40,000	49,300	49,100	53,200	56,900	60,700	63,900	66,700	71,700	79,400	83,800	89,700	102,600
Scientific and mechanical measuring instruments	381-82	22,600	23,100	18,400	28,100	29,800	28,300	32,600	34,100	38,400	42,200	46,800	55,800	64,700	(1)	(1)	(1)
Optical, surgical, photographic, and other instruments	383-87	24,700	29,100	37,500	44,500	57,300	58,300	62,800	67,700	71,500	75,300	77,900	81,100	89,700	98,400	103,800	(1)
Other manufacturing industries	21,27,31,39	(1)	(1)	23,700	39,100	40,000	35,400	40,600	43,300	47,800	51,900	51,700	53,400	57,200	61,900	77,400	84,500
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	(1)	(1)	31,000	38,300	44,200	45,000	45,600	49,300	52,400	49,700	56,500	63,200	76,600	83,500	86,400	(1)
Distribution by size of company (based on number of employees)																	
Less than 1,000		11,600	12,000	18,600	25,200	(1)	31,200	32,400	32,900	36,400	40,500	45,200	44,700	47,900	53,500	56,300	63,700
1,000 to 4,999		[7]27,200	25,100	29,400	33,700	(1)	38,100	40,600	43,200	46,700	46,800	51,600	54,100	66,100	70,200	68,600	81,300
5,000 to 9,999		[7]39,400			36,700	38,300	41,000	38,800	43,700	50,000	55,300	60,300	61,600	52,200	56,100	71,400	85,800
10,000 to 24,999			38,700	41,400		51,400	55,700	48,700	49,100	51,800	53,700	57,500	63,500	79,400	84,100	86,200	94,000
25,000 or more					45,800			63,600	68,700	72,700	76,600	82,700	80,000	88,800	96,200	105,800	115,300

NOTE: The number of R&D scientists and engineers derived by using the arithmetic mean of the full-time-equivalent of R&D scientists and engineers employed in the Januaries of two consecutive years.

[1] Not separately available but included in total. See general notes.
[2] Included in the other manufacturing group.
[3] SIC codes 3398 and 3399 included in the nonferrous metals and product groups for 1957-63.
[4] Data not tabulated at this level prior to 1972.
[5] Data not tabulated at this level prior to 1977.
[6] Included in other electrical equipment group.
[7] Estimated by the National Science Foundation.

SOURCE: National Science Foundation.

Table B-56. Cost per R&D scientist or engineer[1] by industry and size of company: 1981

Industry	SIC code	Companies with total employment of--					
		Total	Less than 1,000	1,000 to 4,999	5,000 to 9,999	10,000 to 24,999	25,000 or more
Total	....	$103,722	$63,687	$81,342	$85,841	$94,011	$115,328
Food and kindred products	20	95,867	(2)	(2)	(2)	(2)	88,741
Textiles and apparel	22,23	62,000	(2)	(2)	(2)	67,852	81,197
Lumber, wood products, and furniture	24,25	(1)	85,836	(2)	157,956	(2)	107,385
Paper and allied products	26	(2)	(2)	50,457	55,059	(2)	70,682
Chemicals and allied products	28	92,851	50,618	74,642	88,324	87,765	116,110
Industrial chemicals	281-82,286	111,242	(2)	(2)	(2)	(2)	124,417
Drugs and medicines	283	(2)	(2)	(2)	(2)	(2)	79,358
Other chemicals	284-85,287-89	(2)	51,458	70,001	77,517	(2)	(2)
Petroleum refining and related industries	29	(2)	42,059	186,332	(2)	(2)	(2)
Rubber products	30	(2)	39,381	(2)	(2)	140,961	(2)
Stone, clay, and glass products	32	(2)	66,239	55,269	120,365	(2)	71,720
Primary metals	33	106,467	61,924	79,243	138,719	80,194	124,004
Ferrous metals and products	331-32,3398-99	(2)	(2)	(2)	(2)	(2)	(2)
Nonferrous metals and products	333-36	(2)	(2)	(2)	(2)	(2)	(2)
Fabricated metal products	34	83,399	(2)	(2)	(2)	(2)	(2)
Machinery	35	95,573	61,746	85,086	64,334	81,757	111,151
Office, computing, and accounting machines	357	(2)	(2)	(2)	(2)	(2)	(2)
Other machinery, except electrical	351-56,358-59	(2)	(2)	(2)	(2)	(2)	(2)
Electrical equipment	36	95,189	51,151	77,430	67,144	96,359	102,852
Radio and TV receiving equipment	365	(2)	(2)	(2)	(2)	(2)	74,885
Communication equipment	366	102,755	(2)	(2)	(2)	116,389	105,762
Electronic components	367	71,663	39,163	(2)	(2)	(2)	66,239
Other electrical equipment	361-64,369	(2)	(2)	(2)	37,843	82,821	124,489
Motor vehicles and motor vehicles equipment	371	141,435	(2)	(2)	(2)	(2)	147,594
Other transportation equipment	373-75,379	(2)	(2)	87,845	(2)	(2)	135,283
Aircraft and missiles	372,376	122,856	(2)	228,876	(2)	113,663	121,413
Professional and scientific instruments	38	102,646	67,918	80,744	72,736	105,509	112,763
Scientific and mechanical measuring instruments	381-82	(2)	(2)	69,770	79,294	80,771	84,193
Optical, surgical, photographic, and other instruments	383-87	(2)	(2)	113,067	(2)	128,778	149,202
Other manufacturing industries	21,27,31,39	84,516	49,641	80,884	(2)	71,363	(2)
Nonmanufacturing industries	07-17,41-67, 737,739,807,891	(2)	85,430	78,307	(2)	94,445	(2)

[1] See note on table B-55.
[2] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-57. Cost per R&D scientist or engineer in companies ranked by size of R&D program: 1972-81

Companies ranked by size of R&D program (based on total R&D funds)	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
First 4	$64,500	$68,500	$80,700	$90,500	$102,500	$105,200	$109,400	$121,700	$126,700	$153,800
Next 4	76,300	81,700	80,500	84,000	87,600	94,600	103,800	105,700	119,200	131,300
Next 12	63,100	73,200	76,900	80,600	82,900	79,300	83,800	90,500	93,300	106,800
Next 20	57,500	60,400	62,200	66,400	68,200	75,900	80,800	87,600	97,400	101,000
Next 60	51,000	52,700	66,200	61,400	65,200	69,900	74,200	80,100	90,700	96,400
Next 100	41,600	45,400	49,900	52,400	53,400	57,200	58,700	63,400	71,400	81,600
Next 200	39,700	43,600	44,000	43,600	48,300	54,200	56,900	61,200	72,800	81,600
Average of above 400 R&D performing companies	57,200	61,300	66,900	70,400	74,300	78,100	82,200	88,500	96,600	107,800
Average of the R&D performing companies less above 400	28,300	29,100	32,800	40,100	44,000	44,900	46,200	47,400	56,300	59,500

Note: The number of R&D scientists and engineers is derived by using the arithmetic mean of the full-time-equivalent of R&D scientists and engineers employed in the Januaries of two consecutive years.

SOURCE: National Science Foundation.

Table B-58. Total employment of R&D-performing companies by industry and size of company: 1980-81

[In thousands]

Industry	SIC code	1980						1981					
		Total	Companies with total employment of--					Total	Companies with total employment of--				
			Less than 1,000	1,000 to 4,999	5,000 to 9,999	10,000 to 24,999	25,000 or more		Less than 1,000	1,000 to 4,999	5,000 to 9,999	10,000 to 24,999	25,000 or more
Total	....	17,276	1,456	2,038	1,522	3,442	8,818	17,288	1,294	2,029	1,518	3,366	9,082
Food and kindred products	20	1,332	76	163	155	397	541	1,367	77	159	157	396	579
Textiles and apparel	22,23	715	84	161	103	207	159	652	47	165	96	191	153
Lumber, wood products, and furniture	24,25	290	40	74	61	57	(1)	300	36	69	57	(1)	(1)
Paper and allied products	26	537	21	84	39	164	229	514	20	83	37	159	214
Chemicals and allied products	28	1,278	97	142	108	410	522	1,266	97	136	105	409	518
Industrial chemicals	281-82,286	594	23	37	50	121	363	589	23	33	49	122	362
Drugs and medicines	283	375	21	34	22	180	(1)	376	22	32	(1)	185	(1)
Other chemicals	284-85,287-89	308	53	71	35	108	(1)	301	52	71	(1)	103	(1)
Petroleum refining and related industries	29	703	7	13	(1)	95	586	722	7	12	(1)	(1)	600
Rubber products	30	393	63	65	40	66	159	367	57	66	37	56	152
Stone, clay, and glass products	32	434	68	51	32	195	(1)	400	54	51	(1)	186	(1)
Primary metals	33	1,068	51	132	81	141	662	1,025	41	121	76	137	650
Ferrous metals and products	331-32,3398-99	798	31	95	53	65	554	768	24	86	45	67	546
Nonferrous metals and products	333-36	270	20	37	28	76	(1)	257	18	35	31	70	104
Fabricated metal products	34	570	119	114	100	84	152	550	102	109	104	85	149
Machinery	35	1,847	303	320	191	348	686	2,047	286	340	183	348	890
Office, computing, and accounting machines	357	593	40	47	21	68	417	650	43	77	22	79	429
Other machinery, except electrical	351-56,358-59	1,254	263	273	169	280	268	1,398	244	263	161	269	461
Electrical equipment	36	2,286	161	202	162	322	1,438	2,276	158	198	172	313	1,436
Radio and TV receiving equipment	365	168	17	15	4	(1)	(1)	158	17	15	(1)	(1)	(1)
Communication equipment	366	791	35	21	30	(1)	648	795	37	27	35	56	640
Electronic components	367	371	44	67	46	(1)	(1)	380	43	58	(1)	(1)	(1)
Other electrical equipment	361-64,369	956	65	100	82	161	549	943	61	99	79	156	549
Motor vehicles and motor vehicles equipment	371	1,222	29	42	47	129	974	1,126	23	42	43	104	914
Other transportation equipment	373-75,379	159	7	28	(1)	61	(1)	153	6	26	(1)	61	(1)
Aircraft and missiles	372,376	987	11	25	27	118	806	983	11	27	25	122	798
Professional and scientific instruments	38	862	96	79	87	89	510	844	99	79	82	87	497
Scientific and mechanical measuring instruments	381-82	522	52	44	38	50	(1)	503	55	45	38	49	316
Optical, surgical, photographic, and other instruments	383-87	340	43	35	50	39	(1)	341	43	35	44	38	181
Other manufacturing industries	21,27,31,39	697	77	108	107	172	233	715	77	109	119	159	251
Nonmanufacturing industries	07-17,41-67, 737,739,807,891	1,898	147	235	174	386	955	1,981	94	237	181	410	1,058

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[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-59. R&D scientists and engineers per 1,000 employees by industry and size of company: 1958, 1963, 1967, and 1970-81

Industry and size of company	SIC code	1958	1963	1967	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
Distribution by industry																
Total	....	21	28	27	26	26	24	24	25	26	27	27	27	27	27	29
Food and kindred products	20	6	7	7	7	7	7	7	7	7	7	7	7	6	5	5
Textiles and apparel	22,23	1	3	3	4	3	3	3	3	3	3	3	3	3	3	3
Lumber, wood products, and furniture	24,25	5	4	4	6	7	6	7	7	7	7	7	7	6	6	(1)
Paper and allied products	26	6	6	6	8	8	8	8	8	10	12	12	14	14	14	16
Chemicals and allied products	28	39	40	36	39	41	39	39	40	41	40	42	43	42	42	45
Industrial chemicals	281-82,286	42	40	33	35	35	34	36	37	38	36	38	38	36	36	39
Drugs and medicines	283	46	47	51	65	65	60	57	57	59	64	62	65	62	60	65
Other chemicals	284-85,287-89	30	38	33	30	31	31	29	30	29	28	29	27	27	30	34
Petroleum refining and related industries	29	15	17	18	17	17	16	17	18	19	17	17	19	18	17	20
Rubber products	30	19	20	17	17	15	16	17	17	18	18	19	18	(1)	(1)	(1)
Stone, clay, and glass products	32	(1)	12	14	11	11	10	10	11	11	11	12	13	13	13	14
Primary metals	33	5	5	5	6	5	5	5	5	7	8	8	8	7	7	8
Ferrous metals and products[2]	331-32,3398-99	4	4	4	4	4	4	4	4	5	5	5	6	6	6	7
Nonferrous metals and products[2]	333-36	6	8	8	9	8	7	8	7	11	15	13	12	12	12	12
Fabricated metal products	34	16	15	14	10	11	10	11	11	12	12	12	12	12	14	14
Machinery	35	22	28	28	28	29	31	31	34	36	38	38	39	38	36	35
Office, computing, and accounting machines	357	(3)	(3)	(3)	(3)	(3)	66	65	69	76	79	78	79	75	72	70
Other machinery, except electrical	351-56,358-59	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	18	19	19	18	18
Electrical equipment	36	43	55	43	41	38	37	37	37	40	42	42	41	43	44	48
Radio and TV receiving equipment	365	(5)	(5)	18	32	35	26	20	18	16	15	17	22	29	35	51
Communication equipment	366	52	67	52	46	43	42	43	43	44	45	46	48	53	55	58
Electronic components	367						39	40	40	49	55	54	51	52	55	61
Other electrical equipment	361-64,369	37	41	35	35	32	31	31	32	36	38	35	32	32	32	35
Motor vehicles and motor vehicles equipment	371	16	19	20	20	22	23	22	24	25	25	24	26	26	30	31
Other transportation equipment	373-75,379						14	13	13	13	14	13	13	11	9	9
Aircraft and missiles	372,376	72	99	89	73	74	76	68	72	72	78	85	96	93	92	97
Professional and scientific instruments	38	44	36	32	29	33	33	34	35	38	41	41	42	41	39	44
Scientific and mechanical measuring instruments	381-82	57	38	26	27	31	31	33	35	41	45	45	50	(1)	(1)	(1)
Optical, surgical, photographic, and other instruments	383-87	33	35	35	32	33	34	35	35	37	38	41	44	45	48	47
Other manufacturing industries	21,27,31,39	(1)	9	6	6	7	6	6	6	7	8	7	9	7	7	7
Nonmanufacturing industries	07-17,41-67,737, 739,807,891		9	13	23	22	21	18	17	16	19	16	14	13	11	11
Distribution by size of company (based on number of employees)																
Less than 1,000	....	18	27	28	26	29	28	26	29	26	25	24	25	24	25	31
1,000 to 4,999	....	12	19	16	18	18	19	17	17	17	17	17	18	18	19	19
5,000 to 9,999	....	25	31	15	19	18	19	18	18	17	19	20	17	19	19	19
10,000 to 24,999	....			31	29	28	16	16	16	17	18	19	20	19	20	22
25,000 or more	....						31	31	33	35	34	35	34	34	34	35

Note: The number of R&D scientists and engineers for 1981 is derived by dividing the arithmetic mean of scientists and engineers employed in January 1980 and January 1981 by the number of company employees in all activities in March 1980. Similar procedures were used in earlier years except 1967-69 in which data were derived by dividing the worker-years of R&D scientists and engineers for the year by the March employment figures.

[1] Not separately available but included in total. See general notes.
[2] SIC codes 3398 and 3399 included in the nonferrous metals and products group for 1958-63.
[3] Data not tabulated at this level prior to the 1972 survey.
[4] Data not tabulated at this level prior to the 1977 survey.
[5] Included in the other electrical equipment group for 1958-63.

SOURCE: National Science Foundation.

Table B-60. Total and company R&D funds per employee by size of company: 1963 and 1967-81

Size of company (based on number of employees)	1963	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
	Total R&D funds per employee															
Total..........	$1,110	$1,180	$1,210	$1,220	$1,250	$1,300	$1,386	$1,468	$1,624	$1,728	$1,912	$2,077	$2,240	$2,453	$2,576	$2,998
Less than 1,000......	520	660	(1)	(1)	840	920	892	863	1,010	1,043	1,139	1,051	1,123	1,254	1,418	1,950
1,000 to 4,999.......	580	570	(1)	(1)	770	690	757	758	791	786	852	963	1,066	1,321	1,326	1,583
5,000 to 9,999.......	1,310	560	690	670	720	750	736	790	879	930	1,138	1,261	1,143	1,102	1,332	1,598
10,000 to 24,999.....		1,470	1,450	1,450	1,470	1,540	781	773	837	920	1,041	1,215	1,407	1,549	1,748	2,061
25,000 or more.......							1,962	2,127	2,421	2,644	2,829	2,994	3,045	3,614	3,594	4,045
	Company R&D funds per employee															
Total..........	$470	$580	$610	$660	$710	$760	$818	$905	$1,040	$1,112	$1,233	$1,347	$1,487	$1,650	$1,764	$2,045
Less than 1,000......	360	420	(1)	(1)	510	590	579	580	657	810	893	879	933	956	1,176	1,575
1,000 to 4,999.......	340	370	(1)	(1)	470	480	525	540	572	642	699	790	841	910	1,108	1,332
5,000 to 9,999.......	520	420	470	500	580	620	609	663	729	749	921	1,004	989	987	1,048	1,229
10,000 to 24,999.....		660	690	740	800	850	557	598	688	791	842	927	1,077	1,237	1,414	1,690
25,000 or more.......							1,059	1,204	1,432	1,519	1,651	1,781	1,873	2,271	2,273	2,540

Note: Averages were derived by dividing total and company R&D funds for a calendar year by employment figures for March of that year.

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

section C

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NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

OFFICE OF THE
DIRECTOR

January 21, 1981

Dear Respondent:

The National Science Foundation requests the cooperation of your company in completing the enclosed questionnaire for the 1981 Survey of Industrial Research and Development.

It is vital that your company's data be included since this is the only annual national survey to collect detailed R&D information from a broad sample of U.S. industry, the sector that accounts for almost 70 percent of the total research and development performed in the United States. We would appreciate your help in making the survey results as accurate and complete as possible since the data are used by Government officials to aid in developing policies and programs to strengthen science and technology.

This year we would like you to fill out the biennial "long form" which used to be the standard annual form. As you may remember, last year you received a "short form" which was our attempt to lessen your reporting burden. Since the questions on the "long form" provide data to track research and development funding and personnel, your biennial response to the complete set of questions will improve national time series data. Individual companies find the data useful in assessing their own research and development programs and we are enclosing a copy of "Survey of Research and Development in Industry--How the Data Are Used" which explains how our survey results are used by the Government and the private sector.

The U.S. Bureau of the Census collects and compiles the survey responses for the Foundation. Confidentiality of your company's responses is maintained since the Foundation receives the data only after they have been aggregated by individual industries.

Inquiries regarding the conduct of the survey should be directed to the U.S. Department of Commerce, Bureau of the Census, Industry Division, Washington, D. C. 20233.

We appreciate both your past and continuing participation in this survey. If you desire a copy of the published report or would like to offer a suggestion for improving any aspect of the survey, please contact Dr. Charles E. Falk, Division Director, Division of Science Resources Studies, Room L-602, National Science Foundation, Washington, D. C. 20550.

Sincerely yours,

John B. Slaughter

John B. Slaughter
Director

Enclosures

RD-1-L2 (12-29-81)

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

OFFICE OF THE
DIRECTOR

January 21, 1981

Dear Respondent:

The National Science Foundation requests your company's participation in the 1981 Survey of Industrial Research and Development.

The information provided by this survey is needed to evaluate this country's scientific research effort and to formulate effective public policies designed to promote and strengthen industry's role in scientific and technological innovation. In addition, we have found that individual companies use the aggregate data from this questionnaire in assessing and planning their own research and development programs.

The data obtained from the survey are collected and compiled by the U.S. Bureau of the Census for the National Science Foundation. Inquiries regarding the survey should be directed to the U.S. Department of Commerce, Bureau of the Census, Washington, D.C. 20233.

Your participation in this survey is greatly appreciated. The Foundation will be pleased to send your firm a copy of the published report. Requests should be sent to Dr. Charles E. Falk, Director, Division of Science Resources Studies, Room L-602, National Science Foundation, Washington, D.C. 20550.

Sincerely yours,

John B. Slaughter

John B. Slaughter
Director

Enclosure

RD-1-L1 (1981)
(12-17-81)

UNITED STATES DEPARTMENT OF COMMERCE
Bureau of the Census
Washington, D.C. 20233

OFFICE OF THE DIRECTOR

FROM THE DIRECTOR
BUREAU OF THE CENSUS

We are enclosing your report form and file copy for the "Survey of Industrial Research and Development During 1981" (RD-1). We are also enclosing an instruction manual to assist you in completing the report and a letter from the National Science Foundation, which sponsors this survey, describing the importance of the survey results.

We are alternating between a "long" and a "short" form every other year to minimize respondent reporting burden. The "long" version is being used for 1981. The report form is basically unchanged from the 1979 version (the previous year a long form was used); however, for further clarification, the definitions for items 14A, 14B, and 16A have been modified in the instruction manual.

Please read the instruction manual carefully, since it provides guidelines for reporting. It is recognized that book records for particlar items may not be maintained. In such cases, carefully prepared estimates are acceptable.

This report is authorized by law (title 13, United States Code). Items 2A and 2B and columns 2 and 4 of item 5C are part of the basic statistical program of the Bureau of the Census for manufacturing companies, and reporting of these items is mandatory. Response to the remainder of the inquiries is voluntary; however, your cooperation is needed to make the results of the survey comprehensive and accurate. By section 9 of the same law (title 13), your report to the Census Bureau is confidential. It will be seen only by sworn Census Bureau employees and used only for statistical purposes. The law also provides that copies retained in your files are immune from legal process.

Requests for copies of the resulting publication or any questions concerning the survey should be directed to Special Projects Branch, Industry Division, Bureau of the Census, telephone (301) 763-5598. We appreciate your past cooperation in this important survey and look forward to your continued participation.

Sincerely,

Bruce Chapman

BRUCE CHAPMAN

Enclosures

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RD-1A-L1 (1981)
(12-17-81)

UNITED STATES DEPARTMENT OF COMMERCE
Bureau of the Census
Washington, D.C. 20233

OFFICE OF THE DIRECTOR

FROM THE DIRECTOR
BUREAU OF THE CENSUS

The Bureau of the Census conducts an annual "Survey of Industrial Research and Development" survey under sponsorship of the National Science Foundation. These measures of research and development expenditures by industry are important in analyzing and forecasting long-term economic growth, investigating productivity determinants, formulating tax policy recommendations, and comparing individual research performance against industry averages. Once every 5 years a new sample of firms is selected to rotate respondent reporting burden and to ensure an accurate representation of all the firms.

We have selected your firm for our 1981 survey panel. We have enclosed copies of Form RD-1A, "Survey of Industrial Research and Development During 1981," and a letter from the National Science Foundation which emphasizes the survey's importance. The 1981 report on Form RD-1A should cover your entire domestic company.

This report is authorized by law (title 13, United States Code). Item 2 and columns 1 and 3 of Item 5B are part of the basic statistical program of the Bureau of the Census for manufacturing companies, and reporting of these items is mandatory. Response to the remainder of the inquiries is voluntary; however, your cooperation is needed to make the results of the survey comprehensive and accurate. By section 9 of the same law (title 13), your report to the Census Bureau is confidential. It will be seen only by sworn Census Bureau employees and used only for statistical purposes. The law also provides that copies retained in your files are immune from legal process.

We thank you for your cooperation in this survey. Requests for copies of the resulting publication or any questions concerning the survey should be directed to Special Projects Branch, Industry Division, Bureau of the Census, telephone (301) 763-5990.

Sincerely,

Bruce Chapman

BRUCE CHAPMAN

Enclosures

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SURVEY OF RESEARCH AND DEVELOPMENT IN INDUSTRY - HOW THE DATA ARE USED

The data provided by companies are the sole source of industrial R&D information that enable the National Science Foundation (NSF) to carry out its Congressional mandate to provide Congress and the Administration with information on the Nation's science and technology resources. The industrial R&D data series is a primary resource in estimating, monitoring, and forecasting national R&D efforts. The importance of the industrial R&D survey data to governmental and other users is illustrated by the following examples:

-- The U.S. Office of Management and Budget (OMB), in assisting the President in the preparation of the budget, takes into consideration recent trends in company-funded R&D expenditures when developing budget proposals for Federal funding of research and development.

-- The U.S. Treasury Department used the industry survey data in the development of tax policy relating to research and development.

-- Corporate R&D planners use R&D/net sales ratios developed from industry survey data in their strategic planning activities to assess proposed R&D budget levels for both current and potential product lines.

-- Recently, the Joint Economic Committee of Congress used the historical R&D data series in its analysis of the impact of Federal regulations on industrial research and development.

-- The information is used by multinational firms to compare their own company's performance with industry totals and to examine comparable data on the United States' and other countries' R&D activities. Industry data are transmitted to international organizations, such as the Organization for Economic Co-operation and Development (OECD), which maintain historical data for member countries.

-- Trade associations use the data in special analyses of their industries' activities and frequently reproduce selected data in their publications. They often request data to respond to specific inquiries from their members.

-- University researchers are using the data to examine such questions as: how and why does the contribution of research and development to the growth of productivity differ between individual industries, and how does one industry benefit from the research and development performed by another.

-- Numerous requests for data come from the news media. Most recently, the data have appeared in articles discussing the impact of the tax law changes on industrial R&D activities.

-- A special Presidential advisory committee discussed with NSF staff the relationship between trends in industrial R&D spending and national goals such as health, defense, energy, etc.

The above examples represent only a small sample of the more than 500 direct requests for industrial R&D information received by NSF and the U.S. Census Bureau staff during 1981. In addition, NSF publications in this field are valuable sources of information for researchers.

January 1982

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FORM RD-1 (11-3-81)
(Instruction Manual)

U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
COLLECTING AND COMPILING AGENT FOR
THE NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20233

INSTRUCTIONS FOR SURVEY OF INDUSTRIAL RESEARCH AND DEVELOPMENT DURING 1981

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GENERAL

Information About Reporting: Additional Forms – Reporting on this form may require that companies resort to the use of estimates in answering some of the questions. We are satisfied, however, that the comparability of data among companies with research and development programs is sufficient to develop meaningful totals and measures of changes from year to year.

If you require additional copies of the form, write to the Bureau of the Census, 1201 East Tenth Street, Jeffersonville, Indiana 47132. If you have any questions regarding reporting on this form, write to the Bureau of the Census, ATTN: Industry Division, Washington, D.C. 20233, or call Area Code (301) 763–5598.

Companies Reporting in Survey for the First Time – Companies not reporting in the 1980 survey should fill in the figures for both years. If the company had no expenditures for research and development, complete only "Item 2." Enter "No R&D" in the space for remarks on page 2 of the form, sign and return the form.

Figures for Earlier Years are Preposted on the Form – If your company reported on form RD-1 for 1980 certain figures from that form have been copied to the present form. Please describe in the "Remarks" section (page 3 of the form) the reasons for any substantial increases or decreases in the 1981 figures entered on this form when compared to corresponding 1980 figures. Examples of such reasons are new government contracts, acquisitions, and disposals, revised accounting method, etc. If you acquired or disposed of a unit performing an important amount of research and development during the 2-year period, please identify the unit in remarks, and give the total amount of research and development accounted for by such unit.

Revision of Earlier Year Figures – The 1980 figures should be revised if necessary to assure comparability with 1981 data. Please explain in remarks, any significant change in the 1980 figures. If your company did not report for 1980, fill in the figures for both years; however make no entry for items which were not on the original 1980 report form (dark shaded).

Report for Your Entire Company – Research and development activities for your entire domestic company should be reported, including all subsidiaries and divisions of the company. If you desire to have subsidiaries report separately, please write to the Bureau of the Census and list your subsidiaries.

Period Covered by Report – The figures reported should cover the calendar year if at all possible. However, fiscal year data are acceptable for all items except employment, provided your fiscal year ends between September and March. Please report employment figures (item 2B and 4) for the period identified in each of the items mentioned.

Geographic Area Covered – The data are intended to relate to business firms in the fields of manufacturing, minerals, and other economic areas which operate one or more establishments in one or more of the 50 States or the District of Columbia.

▶ Section I – GENERAL COMPANY DATA

▷ Item 2 – Sales and Employment for Company – In item 2A, report the net sales and receipts of this company and its subsidiaries to customers outside the company. (Exclude domestic intra-company transfers and sales by foreign subsidiaries, however, include transfers to such foreign subsidiaries; and export sales to foreign companies.) The reported figures should represent value f.o.b. plant after discounts and allowances and should not include freight charges; excise taxes should be excluded. In item 2B report the number of persons employed at the company in all activities in the 50 States or the District of Columbia during the pay period which includes the 12th of March 1980 and 1981. This figure would be the same as that shown by the company in item 1 of Treasury Form 941, if the company filed one form 941 for the entire company.

DEFINITION OF RESEARCH AND DEVELOPMENT

Research and development includes basic and applied research in the sciences and in engineering, and design and development of prototype products and processes. For the purposes of this questionnaire, research and development includes activities carried on by persons trained, either formally or by experience, in the physical sciences including related engineering, and the biological sciences including medicine but excluding psychology, if the purpose of such activity is to do one or more of the following things:

1. Pursue a planned search for new knowledge, whether or not the search has reference to a specific application.

2. Apply existing knowledge to problems involved in the creation of a new product or process, including work required to evaluate possible uses.

3. Apply existing knowledge to problems involved in the improvement of a present product or process.

Research and development includes the activities described above whether assigned to separate research and development organizational units of the company or carried on by company laboratories and technical groups not part of a research and development organization. We recognize that the reporting activities of such latter groups will require the use of estimates for some of the questions.

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Activities to be Excluded From Research and Development – Research and development for purposes of this survey does not include quality control, routine product testing, market research, sales promotion, sales service, research in the social sciences or psychology, or other nontechnological activities or technical services.

More specifically, exclude from research and development such nontechnological activities as market research, including statistical surveys of product acceptance, estimates of market size, and studies of channels of distribution; and market development, including the sale of either old or new products to obtain acceptance of them in new outlets; economic research and other research in the social sciences; and legal work in connection with patent applications and litigation, and the sale or licensing of patents.

Also exclude from research and development such technical services as: quality and quantity control tests and analyses, troubleshooting in connection with breakdowns in full-scale production, including related analytical work; technical plant sanitation control; work required for minor adaptations of a specific product to meet the requirements of a specific customer, including installation and servicing in a customer's plant; engineering and other technical service furnished in accordance with agreements to licensees outside the company; aid furnished by the research and development organization to manufacturing divisions to enable them to operate in accordance with previously determined formulas, standard practice instructions, or finished product specifications; aid furnished to develop advertising programs and to promote or demonstrate new products or processes, including the cost of material furnished for trial or demonstration; assistance in preparation of speeches and publications for persons not engaged in research and development; and experimental work performed at the request of the patent division to provide information needed during the prosecution of a patent litigation.

▶Section II – RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY IN THE UNITED STATES

▷Item 4 – Research and Development Scientists and Engineers – Scientists and engineers for this survey are defined as all persons engaged in scientific or engineering work at a level which requires a knowledge of physical or life sciences or engineering or mathematics, equivalent at least to that acquired through completion of a four-year college course with a major in these fields, regardless of whether they held a college degree in the field.

As in the past, the figure on R&D scientists and engineers will be obtained primarily from two sources:

1. Records on the number of scientists and engineers assigned to research and development. This source is satisfactory so long as the scientists and engineers of the unit are assigned to research and development on a full-time basis (i.e., no more than 5 percent of their time is spent on nonresearch and development). For example, for company laboratories performing only research and development, report the number of scientists and engineers on the rolls in January. For other units, use source 2.

2. Figures on the proportion of total work time of scientists and engineers that is devoted to research and development. For example, if the engineering department of a manufacutring plant had 60 scientists and engineers in January 1981 and one-fourth of the scientists' and engineers' time during that month was charged to research and development projects, the figure for the number of research and development scientists and engineers included for that unit would be 15.

Separate figures are requested on the number of scientists and engineers working on Federal and company and other research and development projects. Where research and development work for the Government and for the company is performed by the same group of scientists and engineers, it will be necessary to distribute the total number of such scientists and engineers according to the program, Federal or company, for which the research and development work was performed; i.e., to use the proportion of the total work time of research and development scientists and engineers that is devoted to Federal and company research and development programs, in order to distribute the total reported in item 4C. The resulting figures should be reported to the nearest work-year, in order to present a reasonable division of time assigned to Federal and company and other research and development programs.

Please divide the requested figures into the related cost figures and check the resulting cost figure of research and development per scientist and engineer for reasonableness.

Cost or Receipts for Research and Development Performed Within the Company by Major Type and Source of Funds – Include all costs incurred to support research and development, exclusive of capital expenditures, but including depreciation and overhead. If you perform research and development for others on contract, include the total charged for the work performed, including profit.

The relevant costs usually include but are not limited to the elements listed below:

1. Wages, salaries, and related costs. Material and supplies consumed (or purchased, if consumption figures are not available); utilities, such as telephone, telegraph, electricity, water, gas, and fuel; books and periodicals; travel and entertainment costs and professional dues.

▶Section II – RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY, IN THE UNITED STATES – Continued

2. Property taxes and other taxes (except income taxes) incurred on account of the research and development organization or on the facilities which the research and development organization uses. Insurance expense. Maintenance and repair, including the maintenance of buildings and grounds, depreciation on buildings, equipment, and vehicles; or rentals, if any facilities are leased.

3. Company overhead. Estimate a fair share of the cost of any functions which support research and development activities. The basis and method of estimating overhead costs will depend upon company practice. The important point is to be sure that all companies include an allowance for overhead. Items normally covered in overhead include the following:

Personnel, including personnel, medical and safety departments, and employee or industrial relations department; accounting control and fiscal (Treasurer's office); procurement and inventory, including purchasing, receiving, inspection, storage, transportation, control, and issue of materials and supplies; other services, including legal, public relations, shopwork, analytical work, plant protection, rearrangement of facilities, drafting, printing, duplicating, transportation of material and personnel, maintenance of motor vehicles, messenger service, stenographic service, and photography; salaries and related costs of research executives not on the payroll of the research and development organization.

Do not net your research and development expenditures by the amount of royalties received from either noncompany organizations or company units; or the credits received for research and development work charged or "sold" to other departments or divisions of reporting company or to outside organizations.

Types of Expense to be Excluded From Research and Development Costs – Exclude from the cost of research and development performed within the company the cost of research and development carried on for the company by noncompany research and development organizations of any kind; or fellowships, grants, and gifts to promote research and development or the study of the sciences and engineering. That part of company-held research and development contracts subcontracted to research and development organizations outside reporting company. All work that was done for your laboratories and other technical units by noncompany organizations which are not research and development organizations (for example, model construction by a noncompany model shop) is to be considered as a purchase of equipment, material, or supplies for the company research organization rather than as subcontracted research and development.

Also exclude capital expenditures, royalties paid, patent expense, income taxes, or interest. Income from sale of products manufactured in the research and development organization if these were sold to bona fide customers.

▶Item 5 – Research and Development Performed Within the Company by Type and by Source of Funds

This item provides separate columns for reporting in 1981 the costs of research and development in Federal contracts and subcontracts, and Company and Other research and development by the three types; basic, applied, and development. Definitions of "Federal," and of "Company and Other" are provided below, after the definitions of types and methods for estimating the breakdowns by type.

Types of Research – Breakdown the total reported in item 5 into the categories shown below:

Item 5A – Basic Research – Include the cost of research projects which represent original investigation for the advancement of scientific knowledge and which do not have specific commercial objectives, although they may be in the fields of present or potential interest to the reporting company.

Item 5B1 – Applied Research – Include the cost of research projects which represent investigation directed to discovery of new scientific knowledge and which have specific commercial objectives with respect to either products or processes. Note that this definition of applied research differs from the definition of basic research chiefly in terms of the objectives of the reporting company.

Item 5B2 – Development – Include the cost of projects which represent technical activity concerned with nonroutine problems which are encountered in translating research findings or other general scientific knowledge into products or processes. Do not include routine technical services to customers or other items excluded from definition of research-development above.

Methods of Estimating Research and Development Expenditures by Type – Many of the companies in this survey have accounts they believe substantially meet the definitions used in this survey for basic research, applied research, and development. In most cases, companies have found it possible to allocate their own accounts to these categories.

If your company does not keep records that meet or can be allocated to these specific categories, there are two principal ways to reduce the task of providing the data requested.

1. Isolate the projects that clearly fall in the development category. If your company fabricates products, such development activity will include the design, construction,

and testing of prototypes and models. Some defense contracts typically call for several test models. If your company's research and development frequently involves the development of a "process" as in chemicals and petroleum, such development activity would include operations beyond the bench scale, primarily the design and operations of pilot plants or semiworks.

2. Isolate the organizational units which have research and development activities that can be readily classified. If a company has two or more laboratories, the expenditures of some of these laboratories may be all classified in one or another type of research and development on the basis of the function assigned to the laboratory. There are laboratories assigned only development type work. There are others engaged only in applied or basic research. If research and development work is done in production units as well as in various laboratories, the research and development work in the production units will generally be of a development type.

The separate classification of clearly identified development operations, particularly in the industries producing expensive prototypes, will greatly reduce the balance to be distributed. The distribution will have to be estimated on the basis of a review of individual projects or on the basis of other summaries of the work. Please use the definitions for basic, applied, and development, as given above. If, despite these instructions, you feel that you are unable to distribute your research and development expenditures into groupings approximating the categories requested, please write to the Bureau of the Census describing your accounts and indicating your special problems. The Bureau may be able to make or obtain some suggestions that will be helpful in completing the report form.

Types of Activity Included in Development – The design and operation of pilot plants or semi-works plants so long as the principal purposes are to obtain experience and to compile engineering and other data to be used in evaluating hypotheses, in writing product formulas or in establishing finished product specifications, in designing special equipment and structures required by a process, and in preparing operating instructions or manuals. The engineering activity required to advance the design of a product or a process to the point where it meets specific functional and economic requirements and can be turned over to manufacturing units. The design, construction, and testing of preproduction prototypes and models and "engineering follow-through" in the early production phase is included.

The development of designs for special manufacturing equipment and tools is included but toolmaking and tool tryout are not included. The preparation of reports, drawings, formulas, specifications, standard practice instructions or operating manuals, and other media for transmitting to operating units information obtained from the above activities is included. However, the production of detailed construction drawings or manufacturing blueprints is not included. The question, "When does development end and production begin?" is often asked. If the primary objective is to make further improvements on the products or process, then the work comes within the definition of research and development. If, on the other hand, the product or process is substantially "set," and the primary objective is to develop markets or to do preproduction planning, or to get the production process going smoothly, then the work is no longer research and development.

Source of Funds – A separate column in item 5 is provided for each of the following:

Item 5, Column 2 – Federal – Include the cost of work done on research and development contracts or subcontracts, and research and development portions of procurement contracts and subcontracts during the year.

Do not include here, or elsewhere in the report, research and development contracts and the portions of procurement contracts that you subcontracted to other research and development organizations. To do so would cause duplication in the statistical totals derived from these reports.

Item 5, Column 3 – Company and Other – Include the cost of all company-sponsored research and development performed within the company. (Report company-sponsored research and development performed outside the company in item 12.) Research and development is performed by a few manufacturing companies for others than the Federal Government. Such research and development should be included in this column.

In item 5E, report the expected or estimated cost of company-sponsored research and development that will be performed within the company during 1982.

▶ **Item 6 – Cost of Research and Development by Principal Federal Agency. Distribute the Cost of Federal Research and Development Work (item 5c, column 2 of form RD-1) by Federal Agency** – Companies reporting Federal research and development are asked to provide separate figures for the four categories of Federal agencies: Department of Defense, National Aeronautics and Space Administration, Department of Energy, and all other Federal agencies. In general, most companies performing large amounts of research and development for the Government will have one or more separate organizational units charged with responsibility for most Federal contracts. Reporting of the requested data has been simplified for some companies by using the data available from the accounts of such units as the basis for the overall company figures on the number of scientists and engineers and the costs of Federal programs. For example, if 80 percent of the work for Federal agencies is performed by units with separate accounts, it should be reasonable to estimate the company totals on the basis of such figures rather than make special tabulations or separate estimates for each of the company units that may be doing some work on government research and development.

▷Item 7 – Cost or Contract Value of Research and Development Performed Within the Company by Major Type of Expense – The type of information requested here will be available for separate research and development organizational units or for companies with separate research and development accounts. It is not requested that special analyses be made of cost records where research and development and other functions are combined and if existing records do not yield estimates for this item, the item need not be completed. However, if most research and development is performed in units where summaries are regularly prepared by element of cost it should be possible to base the breakdown of research and development costs upon the records of such establishments.

For wages and salaries report the gross earnings paid in calendar year 1981 to employees engaged in research and development, including dismissal pay, paid bonuses, vacation and sick-leave pay, and compensation in kind, and prior to such deductions as employees' Social Security contributions, withholding taxes, group insurance, and savings bonds. (You should follow the definition of salaries and wages that is used for calculating the withholding tax.) Include salaries of officers in the research establishment(s). If a corporation; exclude payments to proprietor or partners, if an unincorporated concern. Exclude payments to members of armed forces and pensioners carried on your active payroll. (Scientists and engineers are defined on page 3, item 4.)

For materials and supplies, report the delivered cost for all purchased materials consumed, whether received from other companies, withdrawn from inventory, or received from other establishments of this company.

Item 7B – Materials and Supplies, and Item 7C – Other Costs may be combined if a separate figure cannot be obtained or reasonably estimated from present accounts.

▷Item 8 – Fields of Basic Research – The following definitions are supplied for fields included in the item:

Engineering – Includes aeronautical, astronautical, chemical, civil, electrical, and mechanical engineering, and metallurgy and materials.

Geological sciences – Includes geodesy, hydrology, geochemistry, seismology, soil sciences, etc.

Atmospheric sciences – Includes aeronomy, weather modification, meteorology, etc.

Biological sciences – All sciences, other than clinical medical sciences, which deal with life processes, including plant and animal sciences, bacteriology, pathology, microbiology, pharmacology, etc.

Clinical medical sciences – All sciences concerned with the use of scientific knowledge for the identification, treatment, and cure of disease. Includes internal medicine, neurology, preventive medicine and public health, psychiatry, dentistry, pharmacy, etc.

Other sciences – To be used for multidisciplinary and interdisciplinary projects which cannot be classified within one of the above primary fields of science.

▷Item 9 – Applied Research and Development by Product Group – Enter both Federal and total costs of Applied Research and Development by product group. Costs should be entered in the field or product group in which the research and development project was actually carried on regardless of the classification of the field of manufacturing in which the results are to be used. For example, research on an electrical component for a farm machine should be reported as research on electrical machinery. Also, research on refractory bricks to be used by the steel industry should be reported as research on stone, clay, glass, and concrete products rather than primary ferrous metals, whether performed in the steel industry or the stone, clay, glass, and concrete industry.

Research and development work on an automotive head lamp would be classified in group 25, regardless of whether performed by an automotive or electrical company. Fields of Applied Research and Development are listed below. For those companies familiar with the Standard Industrial Classification, the 1972 SIC number or numbers are given after each title. Note, however, that the SIC definition here applies to the field of research and development effort, and not necessarily to the field in which your company's manufacturing output is classified.

Product Group

1. **Atomic Energy Devices** – Applied Research and Development on atomic energy devices should be included with research and development as classified in the categories listed on lines 2–33. Examples of the fields of research and development activities on atomic energy devices and the product groups in which such activities should be reported are as follows:

Activity	Product Group No.
Radioactive isotopes and other radiation sources	4
Partially fabricated reactor fuel element materials and control rods	12
Nuclear reactors	14
Reactor components and equipment	
Core structurals (barrels, cans, boxes, plates, etc.)	
Heat exchangers and condensers	
Valves	
Complete reactor fuel elements and control rods for use in:	
Propulsion	
Power plants	
Other	
Atomic waste casks	
Fuel handling equipment	20
Control rod drive mechanism and components for:	
Power plants	
Propulsion	
Other	
Pressurizers, components, and auxiliary equipment	
Pumps	
Accessory instrumentation for reactor control	22
Atom smashers (particle accelerators)	24
Hot laboratory equipment	31
Special instrumentation	

2. **Foods and Kindred Products (SIC 20)** – Foods and beverages for human consumption and certain related products, such as vegetable and animal fats and oils, prepared feeds for animals and fowls.

3. **Textile Mill Products (SIC 22)** – Mill preparation of fibers and mill manufacture of yarn, thread, braids, twine, and cordage; manufacture of broad and narrow woven fabric, knit fabric, carpets and rugs from yarn; dyeing and finishing fiber, yarn, and knit apparel; coating, waterproofing, or otherwise treating fabric; the integrated manufacture of knit apparel; and other finished articles from yarn; the manufacture of felt goods, lace goods, bonded fiber fabrics, and miscellaneous textiles.

4. **Basic Industrial Inorganic and Organic Chemicals (SIC 281 and 286)** – Includes radioactive isotopes and other radiation sources.

5. **Plastics Materials and Synthetic Resins, Synthetic Rubber, Synthetic and Other Manmade Fibers Except Glass (SIC 282)** – Exclude glass.

6. **Drugs (SIC 283)** – Medicinal chemicals, biological and botanical products, and pharmaceutical preparations.

7. **Agricultural Chemicals (SIC 287)** – Fertilizers, agricultural pesticides, and other agricultural chemicals.

8. **All Other Chemicals (balance of SIC 28)** – Explosives, soaps, glycerins, detergents and cleaning preparations, paints and varnishes, toilet preparations, and miscellaneous chemical products.

9. **Petroleum Refining and Extraction, and Natural Gas (SIC 13 and 29)** – Exclude geological and geophysical exploration activities.

10. **Rubber and Miscellaneous Plastics Products (SIC 30)** – Fabricated rubber such as industrial and mechanical rubber goods and fabricated plastics products.

11. **Stone, Clay, Glass, and Concrete Products (SIC 32)** – Ceramics, glass, clay products, abrasives and asbestos products, cement, stone products, concrete products, and other nonmetallic mineral products.

12. **Primary Ferrous Products (SIC 331, 332, 3462, and 3399)** – Products of blast furnaces, steel works, rolling and finishing mills, iron and steel castings and forgings. Includes partially fabricated reactor fuel element materials and control rods.

13. **Primary and Secondary Nonferrous Metals (balance of SIC 33 and 3463)** – Primary and secondary smelting and refining of nonferrous metals; rolled, drawn, and extruded nonferrous metal products, castings and forgings.

14. **Fabricated Metal Products (SIC 34 except 3462, 3463, and 348)** – Tinware, hand tools, nonelectric heating apparatus, fabricated structural metal products, metal stampings, fabricated wire products, etc. Includes: nuclear reactors; reactor components and equipment; core structurals (barrels; cans, boxes, plates, etc.); heat exchangers and condensers; valves; complete reactor fuel elements and control rods for use in: propulsions, power plants, and other systems; atomic waste casks.

15. **Engines and Turbines (SIC 351)** – Steam engines, steam, gas and hydraulic turbines, diesel and other internal combustion engines, n.e.c.

16. **Farm and Garden Machinery and Equipment (SIC 352)** – Farm machinery, including tractors for farm use.

17. **Construction, Mining, and Material Handling Machinery and Equipment (SIC 353)** – Construction, mining, and oil field machinery and equipment, elevators, conveyors, hoists, industrial trucks, tractors, trailers, and stackers.

18. **Metalworking Machinery and Equipment (SIC 354)** – Machine tools, dies, machine tool accessories, rolling mill machinery, power driven hand tools, wire fabricating machinery and equipment, and automobile maintenance machinery and equipment.

19. **Office, Computing, and Accounting Machines (SIC 357)** – Typewriters; electronic computing equipment; calculating and accounting machines; scales and balances (except laboratory); and other computing and office machines.

20. **Other Machinery, Except Electrical (balance of SIC 35)** – Special industrial machinery, except metalworking, such as food products machinery, textile and paper industries machinery, general industrial machinery and equipment, and miscellaneous machinery except electrical. Includes atomic fuel handling equipment; control rod drive mechanism and components for: power plant, propulsions; pressurizers, components and auxiliary equipment; pumps.

21. **Electric Transmission and Distribution Equipment (SIC 361 and 3825)** – Electric measuring instruments and test equipment, power, distribution and specialty transformers, switchgear and switchboard transformers, etc.

22. **Electrical Industrial Apparatus (SIC 362)** – Electric motors and generators, motor starters and controls, welding apparatus, carbon and graphite brushes, electrodes, capacitors, condensors, and rectifiers. Includes accessory instrumentation for reactor control.

23. **Radio and Television Receiving Sets, Except Communication Types (SIC 365)** – Radio and television receiving sets, except communication types and phonograph records.

Product Group – Continued

24. **Electronic Components and Accessories, Communications Equipment (SIC 366–67)** – Electron tubes, cathode ray tubes, resistors-capacitors, transformers and other components for electronic and products, solid state electronic devices, and telephone and telegraph apparatus. Also includes electronic guidance control subassemblies, radar and radio equipment, and electronic sighting devices. Includes atom smashers (particle accelerators).

25. **Other Electrical Machinery Equipment and Supplies (balance of SIC 36)** – Household appliances, electric lighting and wiring equipment, and miscellaneous electrical machinery equipment and supplies.

26. **Missiles (SIC 376)** – Including frames or structures, launching and handling support equipment and work on the missile system as a whole. Electronic guidance control subassemblies and radar should be included in group 24 above. Rocket motors should be included in group 28 below.

27. **Space Vehicles (SIC 376)** – Including frames or structures, launching and handling support equipment and work on the space vehicle as a whole.

28. **Aircraft and Parts (SIC 372)** – Piloted and unpiloted aircraft and parts of all types, including engines and auxiliary equipment such as landing gear, deicing equipment, and other auxiliary equipment specifically adopted for aircraft. Radar and radio equipment and electronic sighting devices should be included in group 24 above. Aeronautical instruments should be included in group 31 below.

29. **Motor Vehicles and Equipment (SIC 371)** – Applied research and development related to motor vehicles, including automobiles, trucks, busses, and special purpose motor vehicles such as ambulances, fire engines, personnel carriers, amphibian motor vehicles, and truck and automobile trailers, and to motor vehicle equipment and parts (exclude batteries, tires, engine electrical equipment, etc.).

30. **Other Transportation Equipment (balance of SIC 37)** – Shipbuilding, boatbuilding, and repairing, railroad equipment, motorcycles, bicycles, and parts, etc.

31. **Measuring, Analyzing, and Controlling Instruments, Photographic, Medical and Optical Goods; Watches and Clocks (SIC 38 except 3825)** – Engineering, laboratory, and scientific and research instruments, instruments for measuring, controlling, and indicating physical characteristics. Optical instruments and lenses, surgical, medical, and dental instruments; fire control apparatus; ophthalmic goods, photographic equipment; and watches, clocks, etc. Includes hot laboratory equipment, and special instrumentation.

32. **Ordnance, Except Missiles (SIC 348, 3795)** – Artillery, small arms, ammunition, tanks, and parts, etc.

▷Item 10 – Cost of Research and Development Performed Within the Company, by State – List the States in which your research and development laboratories or facilities are located and report the cost of research and development for each State. It is not intended that information reported reflect individual assignments outside the home State of the particular research staff. As much as 10 percent of the total may, if desired, be reported as "Not distributed by State."

▷Item 11 – Research and Development by Functional Category

Energy Research and Development – Include all R&D spending whose purpose is to increase energy resources or capabilities, including the development of energy equipment. Some R&D spending is for joint or multiple purposes. In these instances, estimate and report the portion of cost incurred due to the energy purpose. Energy R&D can include costs of R&D projects (both product and process) on exploration, extraction, transportation, processing, storage, generation (including conversion), distribution, conservation, etc., of present, new, or improved forms of energy. Record energy R&D spending according to type of energy.

Coal R&D activities are to be assigned into three subcategories. **"Synthetic fuels"** includes programs designed to convert coal to gaseous and liquid products. **"Mining"** is composed of programs for developing equipment and techniques to improve the productivity and recovery rates of coal mining.

"Conservation and utilization" includes R&D activities undertaken to reduce consumption either at the point of energy use or in the transmission, transportation, storage, and conversion of energy. Examples of such are R&D undertaken primarily to reduce fuel consumption in manufacturing, to improve the efficiency of transportation of energy products, or to produce an end product which is more efficient in energy consumption.

"All other energy" includes areas such as wind, waste, hydroelectric, etc. Also include in this category, (F), the development of energy equipment which cannot be readily classified in A to E. If the energy source is waste or any other area with pollution abatement aspects, consider carefully whether one of the purposes of the project is pollution abatement.

In a limited number of cases, the separation of joint (multiple) costs which is encouraged in the preceding paragraph may not be feasible. In this circumstance, include total project cost if the primary purpose of a project is energy R&D; do not include any of project cost if the primary purpose of the project is other than energy R&D.

Pollution Abatement Research and Development – Pollution abatement R&D spending for the purpose of reducing or eliminating the emission of pollutants. As used here, abatement includes prevention, treatment, or recycling; pollution refers to the emission of pollutants to the outside of a firm's (or household's) property or activities. Do not include R&D spending to contribute to environmental aesthetics, to increase equipment durability in corrosive environments, to conserve energy (include as energy R&D) and natural resources, or to increase employee comfort, safety, and health.

There can be two types of pollution abatement R&D spending. In some cases, the only purpose of the R&D spending is pollution abatement. Examples are spending on projects to improve or design alternatives to electrostatic precipitators, wet scrubber systems, waste treatment systems, effluent monitoring devices, etc. In such cases, include the total expenditures on the R&D project. In other cases, pollution abatement is one of several purposes. Examples are spending on projects to improve production processes or products and simultaneously reduce the emission of pollutants. Pollution abatement purposes could also be combined with other types of environmental control purposes such as energy conservation or employee safety and health. In all these instances, estimate and report only the portion of cost incurred due to the pollution abatement purpose.

In a limited number of cases, the separation of joint costs which is encouraged in the preceding paragraph may not be feasible. In this circumstance, do not include any of project cost unless the primary purpose of the project is pollution abatement. When the primary purpose is pollution abatement, include the total project cost in your answer.

Do not include any of project cost as being for pollution abatement if expected pollution abatement benefits are incidental. Incidental benefits are those obtained at no extra cost.

Show R&D spending according to the form of pollution being abated. For example, "air" has three subcategories, automotive emissions, electric power plant emissions, and all other, are included under "air." Automotive emissions includes all R&D efforts undertaken to reduce exhaust emissions from automobiles. Electric power plant emissions includes efforts directed toward reducing airborne emissions from electric power plants. All other includes efforts directed at removing sulfer oxide, nitrogen oxides and particulates, and other fossil-fuel pollutants from the atmosphere. Water should include R&D spending on water recirculation or thermal pollution abatement. R&D spending on waste compacting devices should be included under "solid waste," and R&D spending on noise and radiation pollution abatement should be included under "other."

▶Section III – RESEARCH AND DEVELOPMENT PERFORMED OUTSIDE THE COMPANY – (R&D not included in item 5)

▷**Item 12 – Total Company Funds Spent for Research and Development Activities Performed Outside the Company Within the United States** – Report the amount of company funds spent for research and development performed outside of the company within the United States. This item includes contracts to outside organizations, but specifically excludes subcontracting of Federal Government or other company contracts.

▷**Item 13 – Total Company Funds Spent for Research and Development Activities Performed by Foreign Affiliates Outside the United States** – Report the amount of research and development financed by the U.S. parent or its foreign affiliates performed in R&D laboratories, branch plants, divisions, and subsidiaries located outside the United States.

This item excludes R&D activities performed in foreign affiliates financed by foreign governments or other outside organizations.

NOTE: Foreign affiliates are those outside the 50 States or the District of Columbia.

▶Section IV – RESEARCH AND DEVELOPMENT DISTRIBUTION BY SPECIAL CATEGORIES

▷**Item 14 – Product Versus Process Applied Research and Development** – Allocate the total applied research and development dollar figures of item 5B3, columns 2 and 3 ("FEDERAL" AND "COMPANY") to either **product** or **process** research and development, items A and B below. If you are unsure whether the research and development is for a **process** or a **product**, refer to the definitions for each item below. If the expenditures are unclassifiable as **product** or **process**, enter the cost of such research in the **unclassifiable**, item C. Include in your allocation to **product, process,** or **unclassifiable** categories any company overhead associated with the applied research and development that was included in the dollar figures of item 5B3.

Item A – Product Applied Research and Development Costs – Costs for applied research and development oriented towards goods that have the potential for sale to the public or to other firms. If the research and development cost is for your own "process" (see item B), but clearly involves making a product feasible, or is an integral part of product modification, rather than affecting the efficiency with which it is made (e.g., the scale-up of a chemical compound or the development of a completely new manufacturing technology), then it should be classified as a product research and development cost.

▶Section IV – RESEARCH AND DEVELOPMENT DISTRIBUTION BY SPECIAL CATEGORIES – Continued

Item B – Process Applied Research and Development Costs – Costs for applied research and development devoted to reducing costs or increasing output by improvements in the manufacturing process.

Item C – Unclassifiable Applied Research and Development Costs – Applied research and development costs which you are not able to classify as product or process, based upon the above definitions.

Company overhead costs included in item 5B3 and related to projects which can be classified by product or process should be included in items A and B below and NOT in item C.

Item D – Total – Add together the totals for items A, B, and C for each year separately and enter amounts in the appropriate columns.

▷Item 15 – Total Company Funds Expended on Government Regulations – Allocate total company funds (exclude Federal) spent for research and development activities performed to meet the present regulations of the Federal agencies listed and which would not have been performed in the absence of these regulations.

Include expenditures to meet government regulations which have been established but which have a future compliance date. Exclude expenditures to meet anticipated government regulations.

▷Item 16 – Long- Versus Short-Term Research and Development Costs – Allocate the total R&D dollar figures of item 5C columns 2 and 3 ("FEDERAL" and "COMPANY"), based on the actual or estimated future life of each of your projects in the R&D cycle, into the following three categories:

Item A – Less Than or Equal to 2-year Project Life – Include the current year's cost for all projects whose total life in the R&D cycle is expected to be less than or equal to 2 years from inception to completion or termination. Completion refers to the R&D phase only. At the time production planning, design, and engineering begins, R&D is usually over.

A distinction should be made between continuing programs and specific projects. While programs in broad areas may continue for long periods of time, you are asked to treat **specific projects with separate budgets**, definable goals, and project lives, except where projects are sequential, one depending on the other to reach a specified goal. Then you should treat the sequence as a single project.

Item B – 2- to 5-Year Project Life – Include the current year cost of all projects whose total life in the R&D cycle has been or is expected to be more than 2 years but less than or equal to 5 years.

Item C – More Than 5-Year Project Life – Include the current year cost of all projects whose total life in the R&D cycle has been or is expected to be more than 5 years.

Company overhead or other costs included in item 5C should be allocated to items A, B, or C below. The sum of A, B, and C should be equal to item 5C.

Please indicate by marking the appropriate boxes in column e whether the proportion of company funds for **items A, B, and C have been** increasing, decreasing, or have remained about the same during the last 5-year period.

DUE DATE: 60 DAYS AFTER RECEIPT OF FORM O.M.B. No. 3145-0027: Approval Expires July 31, 1984

FORM **RD-1**
(12-8-81)

U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
COLLECTING AND COMPILING AGENT FOR
THE NATIONAL SCIENCE FOUNDATION

SURVEY OF INDUSTRIAL RESEARCH AND DEVELOPMENT DURING 1981

RETURN TO **Bureau of the Census**
1201 East Tenth Street
Jeffersonville, Indiana 47132

Name of person who supplied 1980 data

NOTE: Data supplied in items 2A and 2B and in item 5C, columns 2 and 4, for 1981 on this form, will satisfy the **mandatory** reporting requirement of Census Form MA-121 (title 13, U.S. Code). Although you are not required to complete the other items, your cooperation on these voluntary items is needed to make the results of this survey comprehensive, accurate, and timely.

NOTICE – Your report to the Census Bureau is **confidential** by law (title 13, U.S. Code). It may be seen only by sworn Census employees and may be used only for statistical purposes. The law also provides that copies retained in your files are **immune from legal process.**

Item 1 – NAME AND ADDRESS OF COMPANY – *Please correct any error in name and address including ZIP code*

Group	Survey
4	4001

YOUR FILE COPY

CENSUS USE ONLY	1	2	3	4	5	6

GENERAL INSTRUCTIONS

- Please complete and return this form in the envelope provided within 60 days. Retain the file copy for your records. This report should cover your entire company, including all subsidiaries and affiliates, unless otherwise designated.
- Enter "None" where appropriate rather than leaving a blank space.
- Reasonably accurate estimates are acceptable.
- Be sure 1980 and 1981 figures are comparable.

PLEASE READ ENCLOSED INSTRUCTIONS BEFORE COMPLETING THIS FORM

Section I – GENERAL COMPANY DATA

Item 2 – DOMESTIC SALES, RECEIPTS, AND EMPLOYMENT FOR COMPANY	CT1	1980 [1]	1981 [2]
A. Domestic net sales and receipts of this company *(Thousands of dollars)*	2001	$	$
B. Total domestic company employment in all activities during the pay period which includes the 12th of March 1980 and 1981	2002		

Item 3 – RESEARCH AND DEVELOPMENT EXPENDITURES

Are research and development expenditures for entire domestic company, including subsidiaries and affiliates, reported on this form? . . . . ☐ YES ☐ NO – *Please explain in remarks or on transmittal letter.*

Section II – RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY IN THE UNITED STATES *(Exclude R&D financed by the company but performed by others. Report such R&D in section III.)*

Item 4 – NUMBER OF RESEARCH AND DEVELOPMENT SCIENTISTS AND ENGINEERS *(See Instruction Manual, page 2)*	CT2	January 1981 [1]	January 1982 [2]
A. Federal research and development	3001		
B. Company and other research and development	3002		
C. TOTAL *(Sum of A and B)* →	3099		

Item 5 – COST OR RECEIPTS FOR RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY BY MAJOR TYPE AND SOURCE OF FUNDS		CT2	*Thousands of dollars*			
				1981		
			[1]	Federal funds [2]	Company and other funds, except Federal [3]	TOTAL *(Sum of columns 2 and 3)* [4]
A. Basis research *If "None," please mark* ☐ 35105		3510		$	$	$
B. Applied research and development	1. Applied research	3521				
	2. Development	3522				
	3. Total *(Sum of lines 1 and 2)*	3529				
C. TOTALS *(Sum of A and B3)* →		3599				
D. 1980 TOTALS →		3598		$	$	$

	CT1		
E. Company and other funds, except Federal, budgeted for the year 1982 →	3800	$	

Item 6 – COST OF RESEARCH AND DEVELOPMENT BY PRINCIPAL FEDERAL AGENCY	CT1	*Thousands of dollars* [1]	1981 [2]
Cost of Federal research and development during 1981 *(Breakdown of item 5C, column 2, of this form)*			
1. Department of Defense	3701		$
2. National Aeronautics and Space Administration	3702		
3. Department of Energy	3703		
4. All other Federal Agencies	3704		
5. TOTAL COST *(Sum of 1, 2, 3, and 4)* →	3799		$

Item 7 – COST OR CONTRACT VALUE OF RESEARCH AND DEVELOPMENT PERFORMED WITHIN THIS COMPANY BY MAJOR TYPE OF EXPENSE	CT1	*Thousands of dollars* [1]	1981 [2]
A. Wages and salaries of research and development personnel *(Include scientists and engineers, technicians, secretaries, and other personnel)*	4010		$
B. Costs of materials and supplies consumed (do not include in this item components, models, and other materials supplied by other research organizations)	4020		
C. Other costs (include service and supporting costs, depreciation, and share of overhead)	4030		
D. TOTAL COSTS *(Sum of A through C) (Same as item 5C, column 1 and 4)* →	4099		$

Please continue on page 2

Section II – R&D PERFORMED WITHIN THE COMPANY IN THE UNITED STATES – Continued

(Exclude R&D financed by the company but performed by others. Report such R&D in section III.)

Item 8 – FIELDS OF BASIC RESEARCH *(Of the total reported in item 5A for basic research, please give cost for the following fields.)*	CT1	Thousands of dollars 1	Thousands of dollars 1981 2
A. Chemistry	5001		$
B. Engineering (including metallurgy)	5002		
C. Geological sciences	5003		
D. Mathematics	5004		
E. Physics	5005		
F. Astronomy	5006		
G. Atmospheric sciences	5007		
H. Oceanography	5008		
I. Biological sciences	5009		
J. Clinical medical sciences	5010		
K. Other sciences	5011		
L. TOTAL BASIC RESEARCH COST *(Same as item 5A, columns 1 and 4)* →	5099		$

Item 9 – APPLIED RESEARCH AND DEVELOPMENT BY PRODUCT GROUP *(Of the total reported in item 5B, line 3, for applied research and development, please give cost of project for each of the following. See the instructions on how to classify and define research and development, page 6.)*	CT2	Thousands of dollars 1980 Federal 1	Thousands of dollars 1980 Total 2	Thousands of dollars 1981 Federal 3	Thousands of dollars 1981 Total 4
1. Atomic energy devices *(See instruction Manual, page 6)*					
2. Food and kindred products	6200			$	$
3. Textile mill products	6220				
4. Industrial inorganic and organic chemicals	6281				
5. Plastics materials and synthetic resins, rubber, and fiber	6282				
6. Drugs	6283				
7. Agricultural chemicals	6287				
8. All other chemicals	6289				
9. Petroleum refining and extraction	6290				
10. Rubber and miscellaneous plastics products	6300				
11. Stone, clay, glass, and concrete products	6320				
12. Primary ferrous products	6331				
13. Primary and secondary nonferrous metals	6339				
14. Fabricated metal products	6340				
15. Engines and turbines	6351				
16. Farm machinery and equipment	6352				
17. Construction, mining, and materials handling machinery	6353				
18. Metalworking machinery and equipment	6354				
19. Office, computing, and accounting machines	6357				
20. Other machinery, except electrical	6359				
21. Electric transmission and distribution equipment	6361				
22. Electrical industrial apparatus	6362				
23. Radio and television receiving sets, except communication types	6365				
24. Electronic components and accessories, communications equipment	6366				
25. Other electrical machinery equipment and supplies	6369				
26. Missiles	6197				
27. Space vehicles	6198				
28. Aircraft and parts	6372				
29. Motor vehicles and equipment	6371				
30. Other transportation equipment	6379				
31. Professional and scientific instruments	6380				
32. Ordance, except missiles	6199				
33. Other – *Specify*	6998				
34. TOTAL APPLIED RESEARCH AND DEVELOPMENT COSTS *(Same as item 5B, line 3, columns 1, 2, and 4)* →	6999			$	$

Item 10 – COST OF RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY, BY STATE

Were all of the research and development costs reported in item 5C, column 4, on this form for 1981 performed in the State listed in the address block (item 1) of this form? . . . . ☐ YES ☐ NO

If "No," list the home State and any other States in which the various research and development laboratories or facilities are located, and estimate the costs associated with each State. If necessary, you may report up to 10 percent of your total as "Not distributed by State."

State *(Attach an additional sheet if necessary)*	CT1	Thousands of dollars 1980 Federal 1	Thousands of dollars 1980 Total 2	Thousands of dollars 1981 Federal 3	Thousands of dollars 1981 Total 4
A.	71			$	$
B.	71				
C.	71				
D.	71				
E.	71				
F.	71				

Section IV – RESEARCH AND DEVELOPMENT DISTRIBUTION BY SPECIAL CATEGORIES – Continued

Item 15 – TOTAL COMPANY FUNDS (Exclude Federal) spent for research and development activities performed to **meet the present regulations** of the agencies listed below, and which would not have been performed in the absence of these regulations. **Include** expenditures to meet Government regulations which have been established but which have a future compliance data. **Exclude** expenditures to meet **anticipated** Government regulations.

IF NONE, MARK (X) ——→ ☐ 13000	CT1	*Thousands of dollars* 1	2
			1981
A. Consumer Product Safety Commission	1310		$
B. Department of Energy	1311		
C. Environmental Protection Agency	1312		
D. Federal Aviation Administration	1313		
E. Federal Communications Commission	1314		
F. Food and Drug Administration	1315		
G. National Highway Traffic Safety Administration	1316		
H. Nuclear Regulatory Commission	1317		
I. Occupational Safety and Health Administration	1318		
J. Other Federal agencies – *Specify*	1319		
	1320		
	1321		
	1322		
K. State and local governments	1323		
L. Other – *Specify*	1324		
	1325		
	1326		
M. TOTAL *(Sum of A through L)* ——→	1399		$

Item 16 – LONG VERSUS SHORT TERM RESEARCH DEVELOPMENT COSTS

Allocate the total R&D dollar figures of item 5C, columns 2 and 3 ("FEDERAL" and "COMPANY"), based on the actual or estimated future life of each of of your projects in the R&D cycle, into the following three categories:

	CT1	*Thousands of dollars* FEDERAL 1	2	COMPANY 3	4
			1981		1981
A. Less than or equal to 2-year project life in R&D	1410		$		$
B. More than 2-year but less than or equal to 5-year project life in R&D	1420		$		$
C. More than 5-year project life in R&D	1430		$		$

REMARKS

Name of person to contact regarding this report	Address *(No. and street, city, State, ZIP code)*	Telephone Area code	Number	Extension

CERTIFICATION – This report is substantially accurate and has been prepared in accordance with instructions.

Name of company	Address *(No. and street, city, State, ZIP code)*	
Signature of authorized official	Title	Date

FORM RD-1 (12-8-81)

BEST COPY AVAILABLE

DUE DATE: 60 DAYS AFTER RECEIPT OF FORM O.M.B. No. 3145-0027: Approval Expires July 31, 1984

FORM **RD-1A**
(11-6-81)

U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
COLLECTING AND COMPILING AGENT FOR
THE NATIONAL SCIENCE FOUNDATION

SURVEY OF INDUSTRIAL RESEARCH AND DEVELOPMENT DURING 1981

RETURN TO
Bureau of the Census
1201 East Tenth Street
Jeffersonville, Indiana 47132

NOTICE – Your report to the Census Bureau is confidential by law (title 13, U.S. Code). It may be seen only by sworn Census employees and may be used only for statistical purposes. The law also provides that copies retained in your files are immune from legal process.

Item 1 – Name and address of company *(Please correct if name or address has changed, including ZIP code)*

Group	Survey
4	4001

YOUR FILE COPY

CENSUS USE ONLY	1	2	3	4	5	6

Data supplied in Item 2 and in Item 5B, columns 1 and 3, for 1980 on this form will satisfy the mandatory reporting requirement of Census Form MA-121 (title 13, U.S.Code).

GENERAL INSTRUCTIONS

Please complete and return this form in the envelope provided within 60 days. Retain the file copy for your records. This report should cover your entire company, including all subsidiaries and affiliates, unless otherwise designated.

Enter "None" where appropriats rather than leaving a blank space.

Reasonably accurate estimates are acceptable.

PLEASE READ INSTRUCTIONS AND DEFINITIONS ON REVERSE SIDE BEFORE COMPLETING THIS FORM.

Item 2 – SALES AND EMPLOYMENT FOR COMPANY

	C. T. 1	1980	1981
		Thousands of dollars	
A. Domestic net sales of all products (or receipts for service)	2001	$	$
		Number	
B. Total domestic company employment in all activities during the pay period which includes the 12th of March 1980 and 1981	2002		

Item 3 – RESEARCH AND DEVELOPMENT

A. Was any research and development performed within the company listed in item 1 during 1980 or 1981? ☐ Yes – *Complete items 2A, 2B, 4, 5, and 7* ☐ No – *Complete items 2A, 2B, and 7 and return this report*

B. Were any company funds spent for research and development activities outside the company listed in item 1 during 1980 or 1981? ☐ Yes – *Complete items 2A, 2B, 6, and 7* ☐ No – *Complete items 2A, 2B, and 7 and return this report*

Item 4 – NUMBER OF RESEARCH AND DEVELOPMENT SCIENTISTS AND ENGINEERS ***(See instructions on reverse side)***	C. T. 2	JAN. 1981	JAN. 1982
	3099		

Item 5 – COST OR RECEIPTS FOR RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY	C. T. 2	***Thousands of dollars***		
		Federal funds 1	Company and other funds except Federal 2	TOTAL ***(Sum of columns 1 and 2)*** 3
A. 1980 TOTALS	3598	$	$	$
B. 1981 TOTALS	3599	$	$	$
C. Company and other funds, except Federal, bugeted for the year 1982	C. T. 1 3800		$	

Item 6 – TOTAL COMPANY FUNDS SPENT FOR RESEARCH AND DEVELOPMENT ACTIVITIES PERFORMED OUTSIDE THE COMPANY BUT WITHIN THE UNITED STATES	C. T. 1	1980	1981
	9001	$	$

Item 7 – STATUS OF THIS COMPANY ON DECEMBER 31, 1981

A. Was the company listed in item 1 owned or controlled by another company on December 31, 1981? ☐ Yes – *Complete item 7B* ☐ No

B. New owner information

Name			Date acquired
Address *(Number and street)*			Federal Social Security Employer Identification Number, if available
City	State	ZIP code	

Item 8

Name of person to contact regarding this report	Address *(Number and street, city, State, ZIP code)*	Telephone *(Area code, number, extension)*

CERTIFICATION

This report is substantially accurate and has been prepared in accordance with instructions.

Name of company	Address *(Number and street, city, State, ZIP code)*	
Signature of authorized official	Title	Date

BEST COPY AVAILABLE

INSTRUCTIONS AND DEFINITIONS FOR SURVEY OF INDUSTRIAL RESEARCH AND DEVELOPMENT DURING 1981

General Instructions – Figures reported on sales and employment (items 2A and B) should cover your entire company, including all subsidiaries and affiliates, unless otherwise designated. The sales figures should exclude excise taxes and other discounts and allowances such as freight charges. The cost figure reported should cover the calendar years if at all possible. Please report your employment data (items 2B and 4) for the period prescribed on this report form.

1980 figures have been entered for companies reporting in the 1980 survey, and may be revised as necessary. If blank, please complete the information for 1980 also.

Geographic Area Covered – The data are intended to relate to business firms in the fields of manufacturing, minerals, and other economic areas which operate one or more establishments in one or more of the 50 States or the District of Columbia.

Scientists and Engineers – Scientists and engineers for this survey are defined as all persons engaged in scientific or engineering work at a level which requires a knowledge of physical or life sciences or engineering or mathematics equivalent at least to that acquired through completion of a 4-year college course with a major in these fields, regardless of whether they held a college degree in the field.

Report the number assigned to research and development. If the scientists and engineers work on research and development and other activities the figure reported should be based on the proportion of the total time that is devoted to research and development.

Research and Development – Research-development includes basic and applied research in the sciences (including medicine) and in engineering, and design and development of prototype products and processes. It does not include quality control, routine product testing, market research, sales promotion, sales service, research in the social sciences or psychology, or other nontechnological activities or technical service.

Cost of Research and Development Work Performed Within the Company – All costs incurred within the company for wages and salaries, direct material costs, services and supporting costs, and an appropriate share of company overhead to conduct research and development activities. If you did research and development for others, include the total amount charged for such work.

Under Federal funds, include research and development in procurement as well as research and development contracts and research and development subcontracts. Exclude research and development subcontracted to others.

If the company has a separate research-development organization, please exclude the estimated cost of any nonresearch-development activities conducted by that unit; include the approximate cost of research-development activities of company laboratories of technical groups not part of the research organization.

Company Funds Spent in Specified Years of Research and Development Done Outside Your Company – Include in this item payments, in the form of contracts, grants, fellowships, etc., made to commercial laboratories and consultants, educational institutions, hospitals, and research institutions for research and development activities. Please do not include subcontracting of Federal Government contracts or contracts received from other companies. (To do so would cause duplication in the total figure for the survey.)

If you have questions regarding reporting problems on this form, please write to the Bureau of the Census, Industry Division, Washington, D.C. 20233 or call Area Code (301) 763-5598.

FORM RD-2 (11-9-81)

DUE DATE: 15 DAYS AFTER RECEIPT OF FORM

O.M.B. No. 3145–0027: Approvel Expires July 31, 1984

FORM **MA-121**
(11-2-81)

U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS

NOTICE – Response to this inquiry is required by law (title 13, U.S. Code, sections 131, 182, 224, and 225). By section 9 of the same law, your report to the Census Bureau is confidential. It may be seen only by sworn Census employees and may be used only for statistical purposes. The law also provides that copies retained in your files are immune from legal process.

(Please correct any error in name and address including ZIP code)

Group	Survey
4	9901

COMPANY SUMMARY OF RESEARCH AND DEVELOPMENT

1981

RETURN TO

Bureau of the Census
ATTN: Industry Division
Washington, D.C. 20233

Please complete and return this form in the return envelope not later than 15 days after you receive it. Companies with no research and development expenditures should so state in the "Remarks" section, fill in items 1a and 1b, sign, and return the form.

YOUR FILE COPY

PLEASE READ INSTRUCTIONS ON REVERSE SIDE BEFORE COMPLETING YOUR REPORT

Item 1 – SALES AND EMPLOYMENT FOR COMPANY	C.T.1	*(Thousands of dollars)*
a. Net sales and receipts of this company and its subsidiaries during 1981	2001	$
b. Number of employees in this company in all activities in the 50 States and the District of Columbia during the pay period which includes the 12th of March 1981	2002	*(Number)*

	C.T.2	1981 *(Thousands of dollars)*		
		Federal funds 1	Company and other funds, except Federal 2	TOTAL *(Sum of columns 1 and 2)* 3
Item 2 – COST OR RECEIPTS FOR RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY DURING 1981	3599	$	$	$

Remarks

Name of person to contact regarding this report	Address *(Number and street, city, State, ZIP code)*	Telephone *(Area code, number, and extension)*

CERTIFICATION – This report is substantially accurate and has been prepared in accordance with instructions.

Name of company	Address *(Number and street, city, State, ZIP code)*

Signature of authorized official	Title	Date

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▶ GENERAL INSTRUCTIONS

A report should be filed by each company receiving a copy of this form. If your company does not conduct research and development, so state in remarks, fill in items 1a and 1b, sign, and return the form. If you have questions regarding reporting problems on this form, please write to the Bureau of the Census, Industry Division, Washington, D.C. 20233.

Report for your entire company – Research and development activities for your entire domestic company should be reported.

Period covered by report – The cost figure reported should cover the calendar year if at all possible. However, fiscal year data are acceptable, provided your fiscal year ends between September and March.

▶ DEFINITION OF RESEARCH AND DEVELOPMENT

Research-development includes basic and applied research in the sciences (including medicine) and in engineering, and design and development of prototypes, products, and processes. It does not include quality control, routine product testing, market research, sales promotion, sales service, research in the social sciences or psychology, or other nontechnological activities or technical services.

▶ SPECIFIC INSTRUCTIONS BY ITEM

Item 1 – Sales and Employment for Company. In item 1a, report the net billings of this company and its subsidiaries to customers outside the company. (Exclude domestic intra-company transfers and sales by foreign subsidiaries. Include the transfers to such foreign subsidiaries, however.) In item 1b, report the number of persons employed by the company in all activities in the 50 States and the District of Columbia during the pay period which includes the 12th of March 1981.

This figure would be the same as that shown by the company in item 1 of Treasury Form 941, if the company filed one form 941 for the entire company.

Item 2 – Show all costs incurred within the company for wages and salaries, direct material costs, services and supporting costs, and an appropriate share of company overhead to conduct research and development activities.

Under Federal funds, include research and development in procurement as well as research and development contracts and research and development subcontracts. Exclude research and development subcontracted to others.

Remarks (Continued)

other science resources publications

Science Resources Studies Highlights

R&D Funds

	NSF No.	Price
"Federal Science/Engineering (S/E) Support to Universities and Colleges Rose by 6% in FY 1981; Non-S/E Support Down 25%"	83-306	-----
"Real Growth Rate of Academic R&D Expenditures Slowed to 2% in FY 1981"	83-304	-----
"Significant Increase Expected in Industrial R&D Performance of Federal R&D Programs in FY 1983"	82-329	-----
"Growth in Federal Basic Research Support in 1980-83 Moves at Slower Rate than in Previous Four Years"	82-325	-----
"Universities Spent 6% of Separately Budgeted R&D Expenditures for Research Equipment in 1980"	82-316	-----

S/E Personnel

	NSF No.	Price
"No Change in Science and Engineering Student Quality Seen by 60% of Academic Officials: At Least 25% Perceive Improvement"	83-322	-----
"Academic Employment of Scientists and Engineers Continued to Grow in 1982, but Slower than in Other Economic Sectors"	83-317	-----
"Growth in Neuroscience May be Leveling Off"	83-314	-----
"Graduate Science/Engineering Enrollment Rose 2% in 1981, Mostly in 'High-Tech' Fields"	83-310	-----
"Projected Employment Scenarios Show Possible Shortages in Some Engineering and Computer Specialties"	83-307	-----
"Manufacturing Employment Becoming Increasingly More Technological"	83-303	-----
"Growth in Science and Engineering Employment Accelerated in 1980 to 1981—But Demand May Have Slackened in 1982"	83-300	-----

Detailed Statistical Tables

R&D Funds

	NSF No.	Price
Academic Science/Engineering: R&D Funds, Fiscal Year 1981	83-308	-----

S/E Personnel

	NSF No.	Price
Academic Science/Engineering: Scientists and Engineers, January 1982	83-311	-----
Academic Science/Engineering: Graduate Enrollment and Support, Fall 1981	83-305	-----
Characteristics of Doctoral Scientists and Engineers in the United States: 1981	82-332	-----
U.S. Scientists and Engineers: 1980	82-314	-----
Characteristics of Recent Science/Engineering Graduates: 1980	82-313	-----

Reports

R&D Funds

	NSF No.	Price
Federal Support to Universities, Colleges, and Selected Nonprofit Institutions, Fiscal Year 1981	83-315	$6.50
1990 R&D Funding Projections	82-315	$3.50

S/E Personnel

	NSF No.	Price
Science and Engineering Doctorates: 1960-81	83-309	-----
Changing Employment Patterns of Scientists, Engineers, and Technicians in Manufacturing Industries: 1977-80	82-331	-----
Science and Engineering Degrees: 1950-80. A Source Book	82-307	$5.00
Women and Minorities in Science and Engineering	82-302	$7.00
Activities of Science and Engineering Faculty in Universities and 4-Year Colleges: 1978/79	81-323	-----
Young and Senior Science and Engineering Faculty: 1980	81-319	-----
Foreign Participation in U.S. Science and Engineering Higher Education and Labor Markets	81-316	$4.50
Science and Engineering Employment: 1970-80	81-310	$2.75

Composite

	NSF No.	Price
Science and Engineering Personnel: A National Overview	82-318	$5.00
Academic Science: 1972-81. R&D Funds, Scientists and Engineers, Graduate Enrollment and Support	81-326	-----